TECHNOLOGY DEPT.

AMERICAN MACHINIST

April 2, 1941

Industry's Army—*The manual of arms for the machine shop is likely to prove as vital as the draftee's "squads left!"*

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Gaged

To the Needs of Small-Plant Men, Too!

V. L. SHERMAN,
General Superintendent, Tropic-Aire, Inc.

"I believe you have done a great deal to help the Defense Program by publishing the past articles on defense problems. It has helped many of us smaller manufacturers to determine what jobs we can handle efficiently, in order for us to do our part in the Defense Armament Plan."

FRED HERBSTRITH
Owner, Machine Shop

"Your Armament Production Section is in my opinion very useful not only to the manufacturer but to our country as a whole. To the small shop it is inspiring."

ARMAMENT SECTIONS

in every issue

WHAT'S IN THIS ISSUE

FINISH

One of the best articles in this issue is the one beginning on page 279, which deals with the problems of finishing such unwieldy assemblies as kitchen cabinets. Offhand you mightn't worry too much about such problems, but it so happens that the difficulties are common to a lot of other operations, so we thought you'd like to see how Berger Manufacturing Division of Republic Steel licked a few of them. The article's written by E. T. Causer, Berger's works manager. Nowhere in

E. T. CAUSER
. . . favors finishing efficiency

the article, incidentally, will you find any reference to National Defense. Just in case you've had your belly full of the subject for the day.

ALPHABETICAL AID

Except for the OPM, most governmental alphabetical agencies seem to have precious little connection with the national defense program. It may come as a mild shock to learn that a long-established agency, the NYA, is concentrating its main effort on defense. Officially known as the National Youth Administration, this group serves industry by training hundreds of thousands of young people so they can become valuable workers in defense plants. Refreshingly realistic is the NYA. No attempt is made to turn out finished machinists, but rather workers for a particular industry who will require a minimum of breaking in. On page 282 John E. Ryckman, of the Illinois Division of the NYA, outlines some of the work being done in the Middle West. It is typical of the work being done in over 5000 production shops maintained by the NYA throughout the United States and territories.

DOPE FROM d'ARC

On page 286 begins the second part of A. H. d' Arcambal's analysis of What Machinability Means to Defense. As consulting metallurgist for Niles-Bement-Pond's Pratt & Whitney Division, d'Arc has probably bumped up against as many new problems per day as anyone else in the country. And as an officer of long standing in the American Society of Tool Engineers, he's been in a position to tackle a lot of practical tooling terrors. So, if you're running up against a new difficulty or two in connection with that latest defense job, maybe d'Arc's story's got just the right answer.

LAST CHAPTER

Comprising this issue's Armament Section, page 293 as for the past four numbers, is a long article on tooling set-ups for high-explosive shell. This particular installment is notable for two reasons: It completes a series on munitions manufacture comprising a type of article never before published, and it starts the presses rolling on the whole works over again, which is now being published as a complete book. By the time you read this copies will be available. Price, one dollar, each. The volume is of such obvious value we know you'll be looking forward to it eagerly.

PRACTICAL HINTS

When a multiple-punch holder costs more than the die, it's time to devise a cheap method for locating and fastening the punches in place. Why not set them in oversize holes in the holder and babbitt them in place?

The speed of welding locomotive frames depends as much on the comfort and protection of the welder as upon proper welding technique. Air blasts between the frame and welder, suspended face shields and sheet-metal hand guards are three devices to use.

Details on these items are found in "Ideas from Practical Men," page 290.

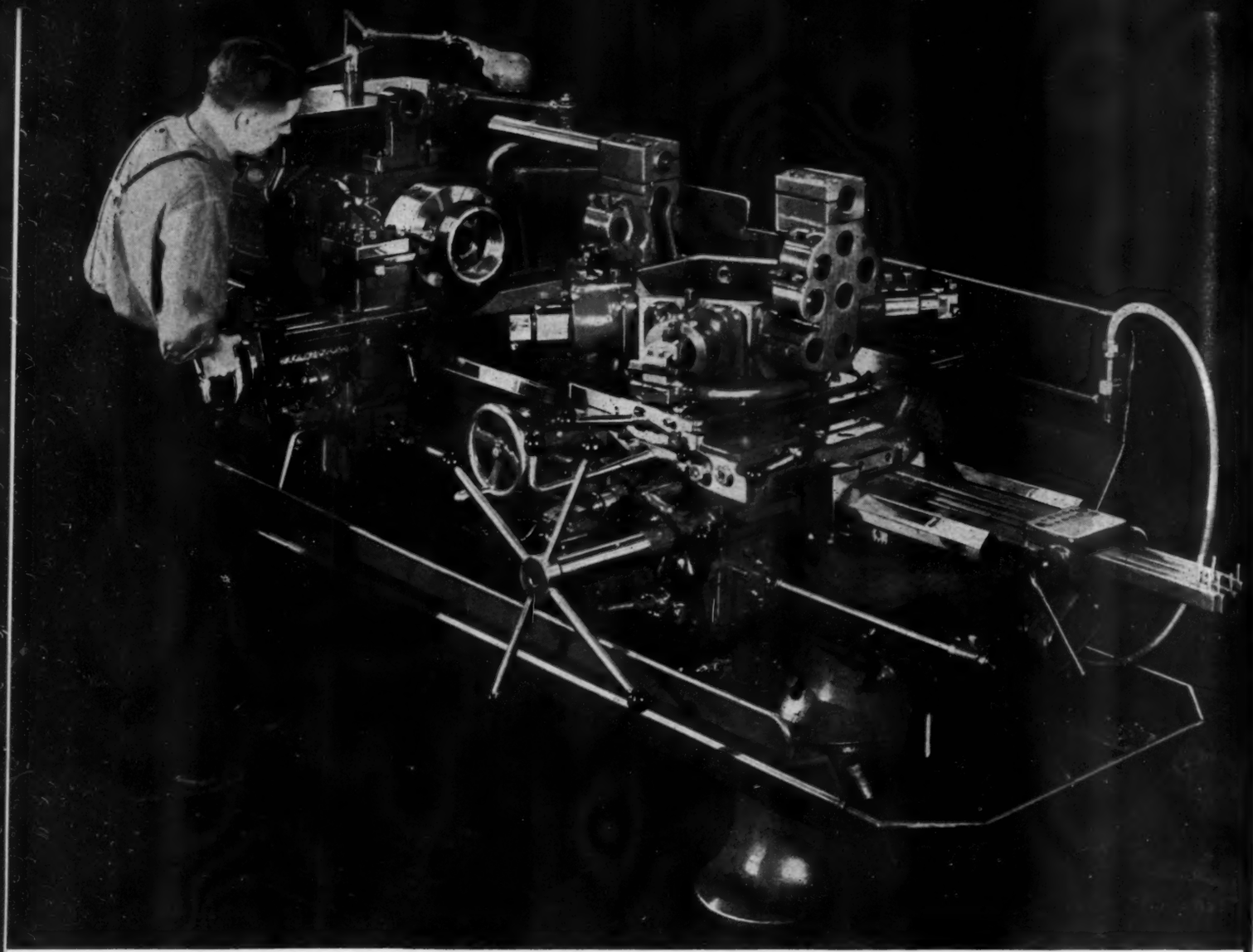
J. R. GIER
. . . less harm while hot

GAS AGAIN

Controlled Gas Guards Steel is the title of a story which really should have been labelled Control of a Furnace Atmosphere Which Makes Possible Protection of Steel Against Surface Decarburization. Always on the lookout for short, snappy title, we vetoed the latter, substituted the former, and stuck the story on page 284. There you will find it, barring some catastrophe which occasionally descends upon the publishing business. It's worth rooting around to find, though, as J. R. Gier would no doubt agree. Mr. Gier, Westinghouse Research Engineer, is the author.

COMING

Something else you can also look forward to is a series of articles on hard chrome plating. Not to be confused with decorative chromium, hard chrome is a valuable device for prolonging the life of many types of tools, dies, gages and the like. Naturally, its applications and technique involve some problems of importance, and it's these the series will discuss. Also scheduled for an early number is another article on training and a story on dynamic balancing. The Armament Section, of course, will still be with us, with present plans calling for a discussion, of trench mortar manufacturing technique, similar to the previous articles on shell. All this, more too, in a single issue of AMERICAN MACHINIST!



CINCINNATI ACME

Versatility and Accuracy For Aircraft Turning Jobs

At the Pratt & Whitney Aircraft plant, the Cincinnati Acme Universal Turret Lathe shown above is performing four operations on steel liners for one of the large main bearings of Pratt & Whitney Radial Engines. Turning, boring, facing and chamfering are done on the part in this one set-up.

Cincinnati Acme Universal Turret Lathes are chosen by aircraft manufacturers for Accuracy—to meet the rigid specifications of the industry. . . . Versatility—to handle long or short runs on a wide variety of parts. . . . Speed—for profitable high production and for maximum efficiency with carbide and similar tools.

Write for engineering suggestions on any problem of Turret Lathe production.

The ACME MACHINE TOOL CO., ... CINCINNATI, OHIO.

Assembly of kitchen cabinets fits nicely into the conveyor system after units leave the bake ovens. Assembled cabinets are carried away from this section by a conveyor serving the crating department

Steps Saved in Metal Finishing

BY E. T. CAUSER, WORKS MANAGER, BERGER DIVISION, REPUBLIC STEEL CORPORATION

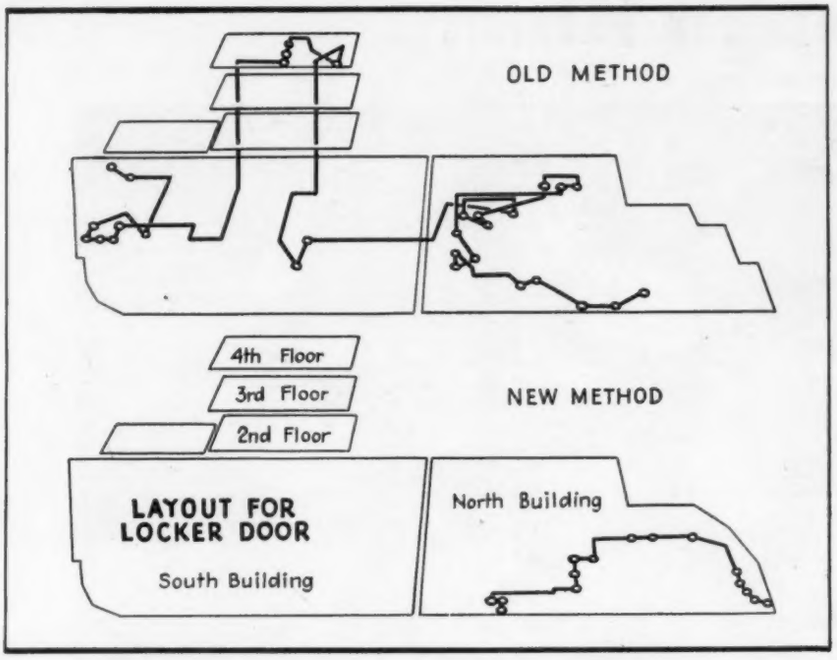
A smart housewife saves steps in the kitchen. Here's a firm whose new plant layout saved enough to meet record work schedules on kitchen cabinets

REVIVAL OF domestic building has stimulated metal-goods manufacture in many lines, but one of its most interesting effects is the birth of a new industry—the manufacture of enameled sheet-steel kitchen cabinets. These trim ensembles, comprising sink cabinets, base cabinets and related wall cabinets, are on display everywhere in model homes and large housing projects. In fact, one of the latter, Parkchester, being erected for Metropolitan Life in the Bronx, N. Y., will require 73,535 cabinets for installation in 12,273 kitchens.

Fabrication of such an order is strictly a tonnage proposition, and few U. S. concerns are equipped to produce 365 complete kitchen ensembles per day along with other sheet-steel products. The successful bidder, Berger Manufacturing Division of Republic Steel Corporation, foresaw the rapidly expanding market for kitchen cabinets and other sheet-metal equipment. So the company took steps to enter this field on a profitable basis.

Berger manufactures a wide variety of sheet-steel products in Plant No. 1. Three years ago this plant could no longer compete unless something were done about obsolete finishing methods. Except for shelving and some locker parts, most material requiring enameling was trucked from press and brake departments in the north building to an elevator in the south building. Here the work was lifted to the third floor for black assembly and next to the fourth floor for finishing by hand racking at spray booths. Finished work was trucked from the fourth floor to the far end of the south-building main floor for final assembly, packing and shipping. Damage to finished work in transit was a considerable item, principally because so many hand operations were involved in moving work from one operation to the next.

Finishing was the bottleneck, so the management decided to embark upon an extensive rearrangement and modernization program, now virtually completed. Objects were: (1) to place production of related articles on a straight-line basis so far as possible,



TYPICAL SAVINGS BY PLANT REARRANGEMENT

	Number of Operations			*Distance Traveled (feet)*		
Product	*Old Set-up*	*New Set-up*	*Saving*	*Old Set-up*	*New Set-up*	*Saving*
Boiler Jacket Front...	32	24	25%	4865	1655	66%
Shelf (12 x 24 in.).....	12	8	33%	2110	615	71%
Locker Door.....	29	16	45%	3350	850	75%
Kitchen Cabinet.....	35	23	34%	3420	1760	47%

How Steps Were Saved

BOILER JACKET

1. By developing tools that combined punching operations
2. By changing from manual handling to conveyor handling in finishing
3. By introducing conveyor handling in the packing department

SHELF (12 x 42 in.)

1. By blanking and punching complete from sheets, instead of shearing to size as a separate operation, followed by punching
2. A conveyor eliminated handling into and out of a dip tank

LOCKER DOOR

1. A roll punching machine equipped with three die sets completely notches the corners and punches the 16-gage door sheet in one pass
2. Five forming operations were eliminated by aligning press brakes to permit operators to pass the part directly from one to another. New dies also combine operations
3. Conveyorized dipping saves handling in finishing, and dipping avoids several operations involved in the former spray method
4. Assembly on a merry-go-round conveyor saves several handling operations involved in the former station-to-station method

KITCHEN CABINET

1. Three operations were saved by combining punching operations
2. New forming tools and fixtures saved four operations
3. Skeleton-type assembly jigs saved two operations in black assembly
4. Originally each piece was trucked individually to old-type spray booths. Now kitchen cabinets progress through the prime and finish coats on conveyors

(2) to eliminate operations by better tooling and installation of conveyors, and (3) to provide adequate high-speed finishing equipment for shelving and locker, kitchen cabinet and special-products sections. The basic purpose of this move was to cut costs. A byproduct is a substantially increased output.

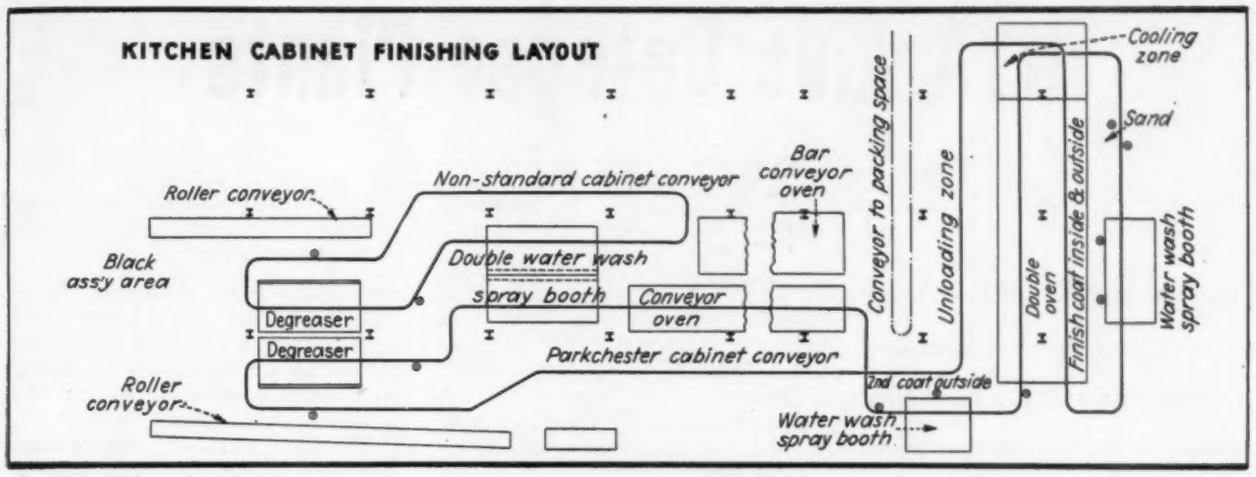
An accompanying table shows the appreciable savings in operations and distances traveled for four typical products. In general, man-hours per unit have been cut 50 per cent for most products. And the investment for the entire rearrangement and modernization program will be paid off in the first two years of operation.

The new production scheme causes like products to be fabricated in straight-line production systems leading away from the focal press and brake departments in the north building. Fabrication, finishing, assembly and shipping of lockers and shelving are done in straight-line sequence in the left end of this building. Mechanical aids cut time and increase capacity. Regular-production items leaving the fabricating division are degreased and immediately hung upon a paint conveyor serving the mechanical dip oven. Upon leaving the oven, locker parts are transferred to an overhead conveyor serving a merry-go-round assembly conveyor. Shelving is transferred from the paint conveyor to a floor conveyor for transportation to assembly and packing.

Special-products finishing has grown to such an extent that a completely new pressure finishing room has been installed in the south building on the main floor, convenient to the black assembly departments. Assemblies are degreased in a new automatic vapor-type machine equipped with a conveyor capable of sharp bends.

Efficiency of the new set-up is indicated by a comparison of old and new methods. In the old set-up, finishing was carried out on the fourth floor by these steps: (1) Clean with naphtha by hand, (2) place in rack and push rack to position in box-type drying oven, (3) remove from oven and transport to spray booth, (4) remove from rack, dust and hang in spray booth, (5) spray enamel, (6) replace in rack, (7) move rack to baking oven, (8) push rack of painted parts in box-type baking oven, (9) remove rack from baking oven, (10) transport rack of parts by elevator from fourth to first floor, (11) remove from rack, inspect and stack on floor for packing, (12) pack in cartons or crates.

In the new set-up two conveyorized baking ovens are maintained. Finishing steps involve: Class A—Large Quantities of One Color, (1) Place parts on conveyor for degreasing, (2)



Kitchen cabinets are now finished in a conveyorized set-up on the second floor of the south building. High-speed, direct-gas-fired ovens bake synthetic enamel in one-third the time required by the former steam-heated ovens

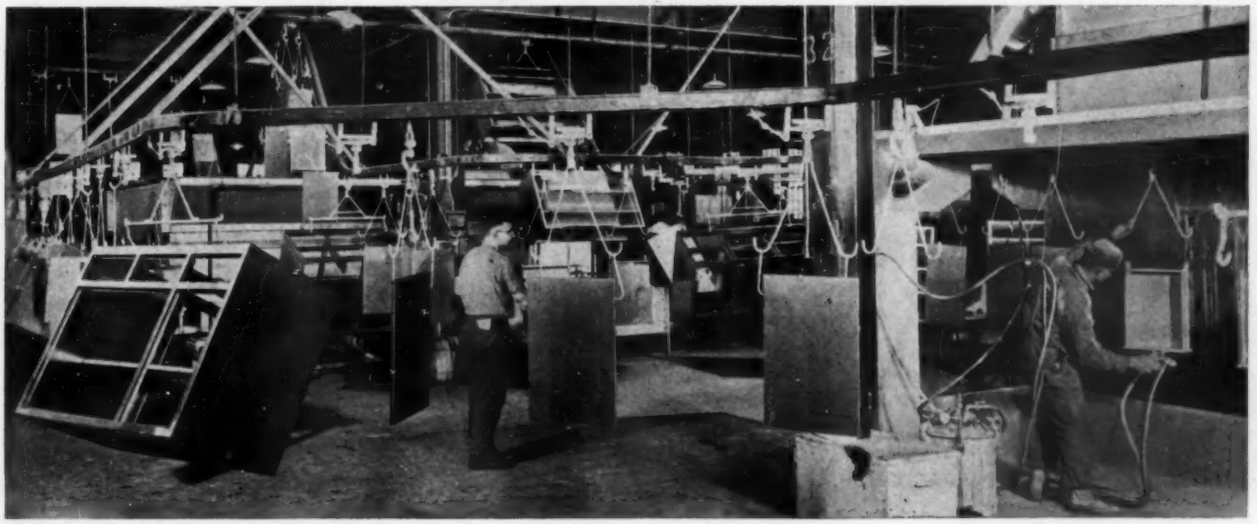
remove from degreaser conveyor, dust, and hang on continuous conveyor that serves two water-wash spray booths and an A-type oven, (3) inspect and transfer to packing conveyor, (4) remove from conveyor and pack in cartons or crates. Class B—Special Colors and Miscellaneous Parts, (1) Place parts on conveyor for degreasing, (2) remove from degreaser conveyor, dust and place on rack conveyor for transportation to water-wash spray booths, (3) remove part from rack, spray and return to rack, (4) rack transported by gravity to air-sealed tunnel-type oven where mechanical pusher conveyor carries rack through oven, (5) inspect and transfer to packing conveyor, (6) remove from conveyor and pack.

Kitchen-cabinet finishing enjoys a new department. Stampings are carried by overhead conveyor from the press and brake departments in the north building to the second floor of the south building. Here facilities have been installed for black assembly along modern spot-welding lines, using skeleton jigs. Roller conveyors transport assembled cabinets to two finishing lines. The shorter of these is for smaller contracts, the larger one for the Parkchester project.

Starting ends of the finishing lines are served by a new double-tank automatic vapor-type degreaser. As assemblies move to the prime coat they are wiped and then pass into a double water-wash spray booth. Non-standard items are baked in an old bar conveyor oven converted from steam heating to direct gas firing.

Parkchester cabinets remain on the longer conveyor for baking the prime coat, for application of the second outside coat in another water-wash spray booth, and then into a new double-pass oven. On the first pass the second outside coat is baked, after which the conveyor doubles back around the outside of the oven for application of the third outside coat and the inside finish coat. The conveyor re-enters the oven for baking these coats and upon emergence it turns the other way to pass by an unloading zone. Inspection and assembly occur here, after which the cabinets are hung upon a conveyor that takes them down to the packing and shipping department on the first floor of the south building.

Time in all ovens has been cut from 1½ hr. to 30 min. by raising the oven temperature from 250 F. to 325 F. This was accomplished by converting existing ovens from indirect steam heating to direct firing using natural gas. Of course, the new ovens represent the most modern types with highly developed burner and control systems.



A kitchen-cabinet base at left is conveyed to a degreaser in the background, and then doubles back to the prime-coat spray booth at the right

NYA Aids Defense Plants

BY JOHN E. RYCKMAN, NATIONAL YOUTH ADMINISTRATION, ILLINOIS DIVISION

National Youth Administration offers to young people hundreds of thousands of part time jobs serving as training places prior to employment in defense plants. Here is "The NYA in Illinois"

WITH INDUSTRY geared at top speed to build American defenses and with workers urgently needed to man the turning wheels, the National Youth Administration has doubled its program to prepare youth for employment in industry. In this program which provides work experience for hundreds of thousands of youth throughout the country, Illinois plays a leading role. Here, under the direction of Administrator Mary Stuart Anderson, thirty-three centers are being opened and more than seven thousand young men and women are daily gaining valuable job experience—groundwork for jobs on the nation's assembly lines.

"Industry's increasing employment, particularly in lines engaged in national defense production, is decreasing the National Youth Administration rolls weekly," states Administrator Anderson. "Many employers have come to look to the NYA for youths who have had some basic work experience and who have acquired stable shop habits."

To employers the NYA work experience centers offers workers, equipped with responsible attitudes, fundamental job techniques and knowledge of the basic tools of industry. Youth who have listened to frequent NYA lectures on accident prevention make safety conscious workers. Youth who have had NYA machine shop experience have an excellent foundation for all general machine shop work. These youth have already been iniated into the procedures of modern industry.

Actual production experience under factory conditions is given to youth, not only in Illinois but throughout the nation. Outside agencies supply the raw materials or the machinery to be repaired. The finished products and repaired machinery are surplus used by governmental and public agencies whose budget normally would not allow purchases. NYA standards demand careful workmanship and each job must pass a rigid inspection.

Explains Administrator Anderson: "In the operation of all centers, the NYA is striving to help both factors in the employment picture—those who want jobs and those who have jobs to offer. By providing youth with experience in the operation of industrial machinery and in handling tools, the way is being made easier for these young people to find places in industry where they will be urgently needed."

The NYA, through mechanical aptitude tests, endeavors to give basic machine shop experience to those youths who have the education and qualifications necessary for skilled workers. In all cases experience is offered on a step-by-step basis. Only as the youth masters one task, is he given another. Although

The NYA maintains over 5000 production shops throughout the United States as well as in Alaska, Puerto Rico and the Virgin Islands. A NYA youth is shown oiling one of the large heavy duty lathes in a machine shop

production is organized on assembly lines the youth are rotated through the various jobs to give them all-around experience.

In the shops experience under skilled supervision is offered on all phases of machine work from repairing turret lathes to threading nuts. The NYA youth, working from blueprints, lay out and assemble the jobs. By working on the common metals youth become acquainted with their uses and properties. Beginners are first taught to use all the hand tools. To pass out of this group the youth workers must be able to handle efficiently the wrenches, files, micrometers, surface and depth gages. Youth showing ability are allowed to work with the machine tools.

Youth are given the opportunity for vocational exploration, for the centers offer other types of industrial work besides machine shop. Basic job experience is provided in sheet metal work, welding, foundry, forge, radio, woodworking, drafting and designing. Aviation ground mechanics experience is included at a few of the centers. For the girls the work experience program offers power sewing, sub-professional nursing, cooking and household work. Twenty of the NYA centers in Illinois are for out-of-town youth and include living quarters as well as work shops. Unmarried young men and women, between the ages of 17 and 24 inclusive, who are in need of work or experience are eligible for NYA employment.

Unmarried citizens from 17 to 24 years are eligible for NYA training which enables young men to acquire stable shop habits prior to employment

Controlled Gas Guards Steel

BY J. R. GIER, RESEARCH ENGINEER, WESTINGHOUSE RESEARCH LABORATORIES

Controlled-atmosphere furnaces can effectively prevent loss of carbon content when steel is being heated. Here's how the atmosphere should do its job

UNLESS special precautions are taken, when steels are heated for hardening they are subject to serious surface damage by chemical attack from the air or other gases in the furnace. This damage is of two kinds: oxidation and decarburization. Oxidation is an obvious form of attack which causes surface scaling, objectionable because it not only destroys surface metal but causes soft spots by interfering with the cooling action of the quench bath.

Decarburization, on the other hand, is a subtle form of injury difficult to detect except by chemical or hardness tests. It seriously impairs the physical properties of the surface metal and indirectly may cause other troubles. This is because, other than iron, carbon is the most important element in all steels; hardness, strength, wear resistance and other physical properties all depend on the amount and physical state of the carbon. At heat-treating temperatures, carbon has an active tendency to escape from the surface of steels and thus damage the metal.

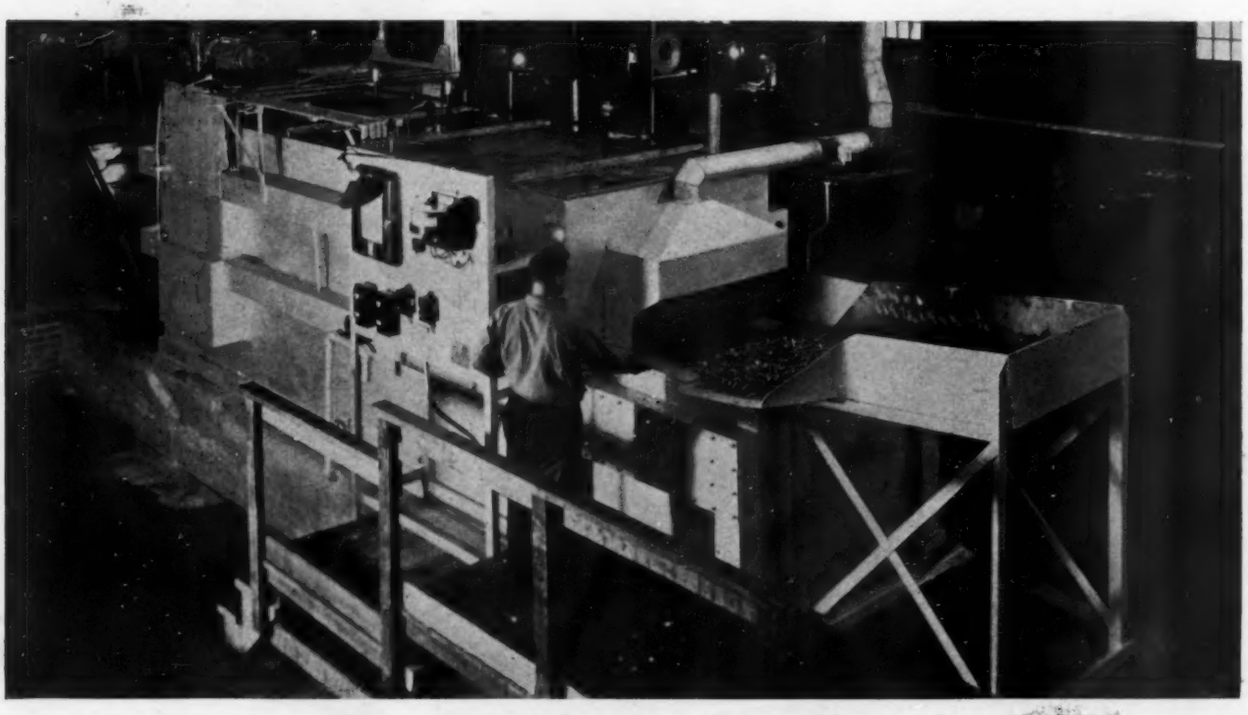
A decarburized surface on a hardened steel part is likely to have high tensional stresses in it produced by the relatively greater expansion, on hardening, of the underlying metal due to its higher carbon content. These stresses reduce the useful strength of the part and may cause cracking.

Another common offense of decarburization is misleading the heat-treater who regulates his treatment to produce certain hardness values. A decarburized part tempered to the desired surface hardness may have too high a core hardness and corresponding lack of toughness.

The need for preserving surface metal quality in hardened steel parts cannot be emphasized too strongly. Maximum stress usually occurs in the surface layers. This fact is well recognized in the manufacture of aircraft engines, where the utmost strength and reliability of materials are demanded, as evidenced in the phenomenal output of one horsepower per pound of weight. To attain such structural efficiency the metals are heat-treated to develop their maximum strength, then they are scrupulously polished over all at great expense to insure freedom from defective surface metal. In this way the inherent strength of the steels is made effective and dependable.

The most common means for avoiding surface damage are: salt baths, lead baths, packing in solid carbonaceous material, adherent coatings and protective furnace atmospheres. While each of these methods has certain advantages and each has been successful in certain cases, it appears that controlled atmospheres offer the broadest solution of the problem.

Controlled atmospheres function by surrounding the hot metal in the furnace with a protective gas to prevent

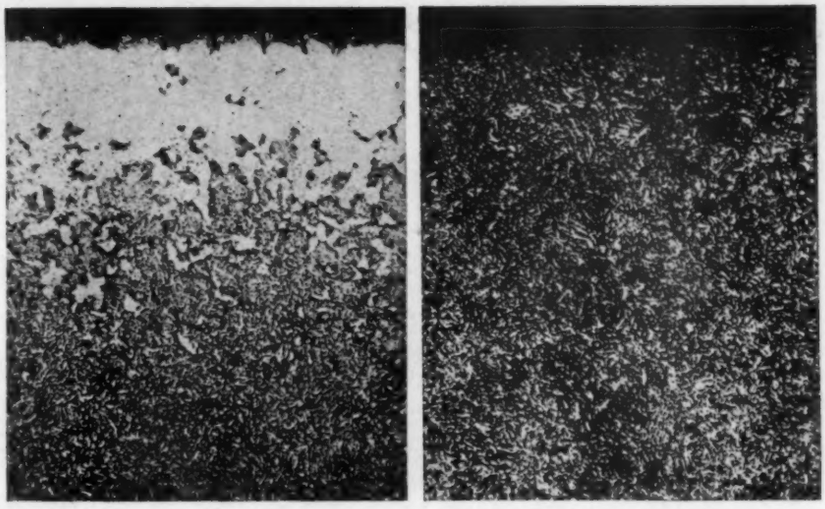


The conveyor type of controlled-atmosphere furnace is ideal for hardening bolts, screws and similar parts

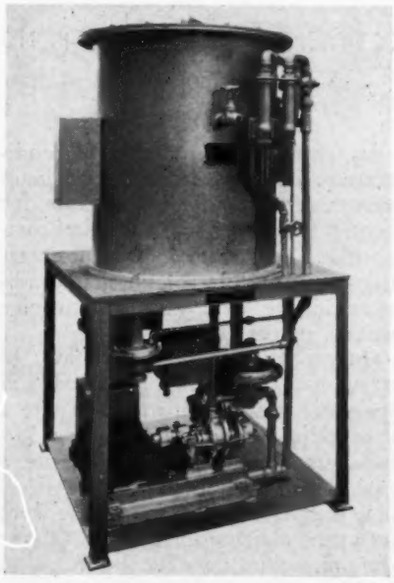
damaging chemical reactions which cause scaling and loss of carbon. The gases used are generally derived from partial combustion of hydrocarbon fuel or charcoal; they contain the reducing gases hydrogen and carbon monoxide, also a large amount of inert nitrogen. Carbon dioxide and water must be present in small but definite amounts, as these in effect control the behavior of the gas toward the carbon.

It is comparatively simple to prevent oxidation, as this requires only that the gas contain more than a certain minimum proportion of hydrogen and carbon monoxide relative to the water vapor and carbon dioxide. Preventing decarburization is much more difficult, because it requires that the amounts of carbon dioxide and water vapor in the gas not only be very small, but must be accurately regulated. Present practice of atmosphere preparation usually requires scrubbing out the carbon dioxide and drying to produce a non-decarburizing gas; but in this procedure there is the danger of taking out too much and making the gas carburizing, which may also be objectionable.

Protective atmospheres previously used in steel hardening furnaces have been only partially effective. Although they do prevent oxidation they usually contain too much carbon dioxide to prevent decarburization. In fact, reducing gases sometimes appear to increase depth of carbon loss, as none of the affected metal is removed in scaling. A recent improvement in protective furnace atmospheres not only prevents oxidation, but more important, gives control of surface carbon content to an extent not previously attained. It is particularly well adapted to mass production furnaces of the conveyor type in which the work moves continuously through the heating chamber and is discharged through a chute into a quench bath. This atmosphere is called Endogas because it is formed by the endothermic reaction of hydrocarbon fuel and air. A special generator is used to carry out this reaction. A feature of the generator is its ability to process the gas completely in one step. The gas is then taken directly to the furnace without the need for drying or removing carbon dioxide.



Surface decarburization of S.A.E. 6150 steel heated in ordinary reducing protective furnace atmosphere is shown by the white zone in the photomicrograph at left. The same steel heated in Endogas shows no change



In this complete Endogas generator, a motor-driven pump supplies a constant mixture of air and gas to the electrically heated catalyst chamber above. Feed ratio is controlled by throttling valves

A typical analysis of this atmosphere, prepared from Pittsburgh natural gas fuel, is: carbon monoxide, 20 per cent; hydrogen, 40 per cent; methane, 1 per cent; and the balance nitrogen. In this case one volume of natural gas yields about five volumes of product gas costing about 30 cents per thousand cubic feet. The product gas contains only a few tenths of one per cent water vapor and even less carbon dioxide. Endogas can be made from any of the usual fuel gases, or if these are not available, bottled propane or butane may be used.

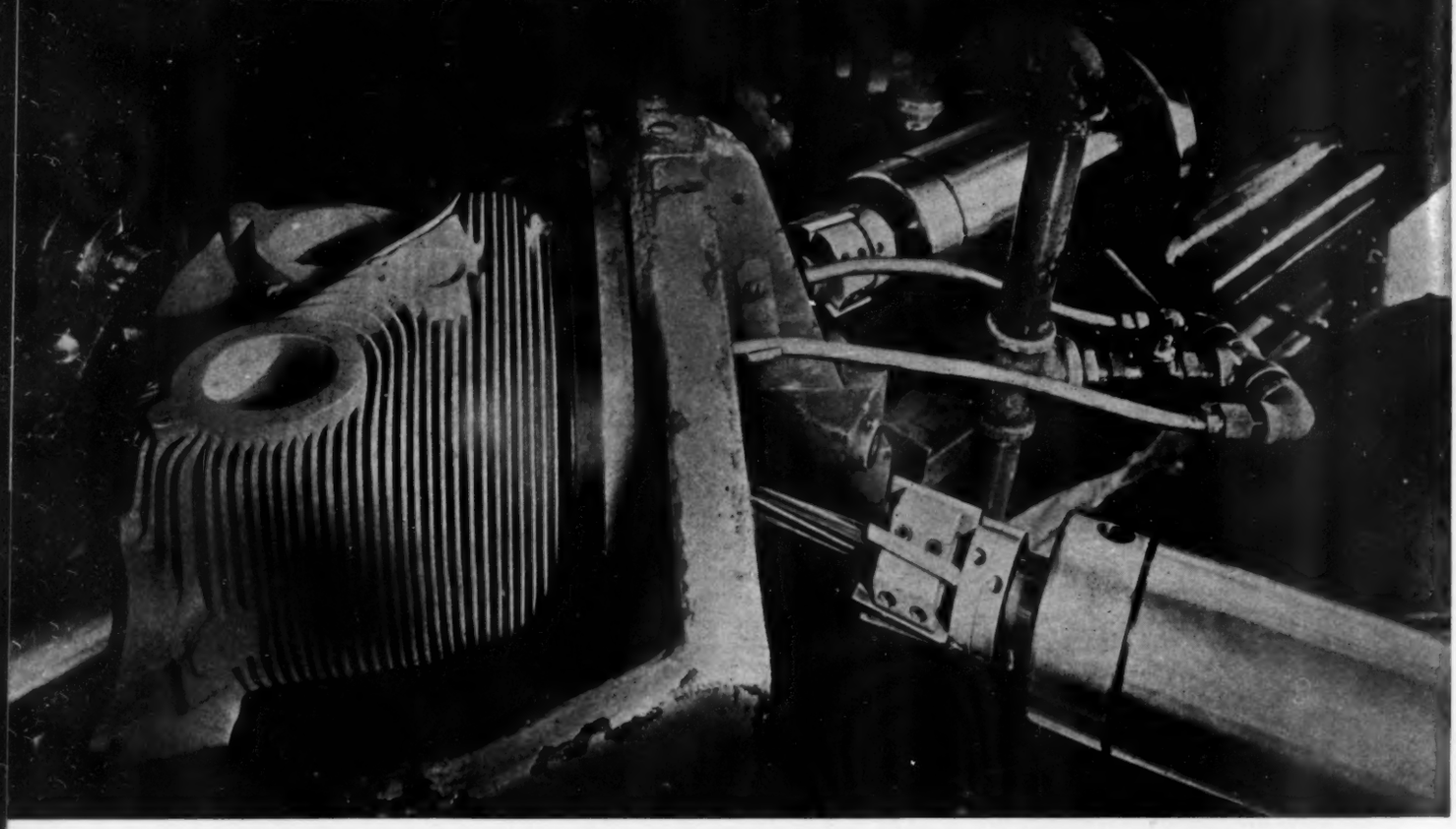
The secret of successful operation of the generator is the very thorough chemical reaction obtained by high-temperature catalysis. By virtue of the effective reactions obtained in the generator the components of the product gas are in mutual chemical equilibrium, which in turn permits close control of their respective concentrations simply by regulating the air-fuel feed ratio. In this way the amount of the harmful components (water and carbon dioxide) can be made as low as desired.

Precise control of composition is important, as it is by this means that the carburizing or carbon-forming tendency of the gas is adjusted to oppose the carbon-losing tendency of the steel. When these two factors are in balance no change in carbon will occur, but when they are not the atmosphere will carburize or decarburize the steel. Carburizing or decarburizing action is controlled by varying the amount of carbon dioxide in the gas, where the total amount is usually too small for measurement by ordinary means. The gas composition is therefore quite critical when a particular balance is sought.

Since the concentrations of all active components of a gas mixture tend to change in a hot furnace by interaction between themselves until they reach chemical equilibrium, for ease of control it is essential that the gas mixture be thoroughly reacted before it enters the furnace. For the same reason it is easier to control the carburizing potential of the product gas by regulating the proportion of air and fuel in the feed to the generator before it is reacted rather than by absorbing excess harmful components afterward. The former method is used in controlling Endogas.

Preparation of protective atmospheres by reacting air and hydrocarbon fuels in a heated catalyst is not a new idea. It is new, however, to react so completely that without further processing the product gas can be accurately adjusted to chemical equilibrium with the carbon in any steel at hardening temperatures.

What Machinability Means to Defense



Excellent finish is obtained through the use of serrated blade reamers on cast aluminum alloy aircraft cylinder heads

BY A. H. d'ARCAMBAL, CONSULTING METALLURGIST, PRATT & WHITNEY DIVISION, NILES-BEMENT-POND

Part II of Mr. d'Arcambal's article tells how to improve machining conditions by the proper treatment of materials

CLOSE COOPERATON between the engineering shop and metallurgical departments insures the proper selection of materials for various parts entering into the assembly of a finished product. SAE X1112, the freest machining steel available, is widely used today for unimportant parts where little strength is required.

Where steel possessing somewhat higher strength, as well as greater freedom from inclusions, is specified, the X1300 series is commonly used. This material is a free-cutting steel and responds readily to hardening. Less important gears, shafts and bolts are fabricated from steel of this grade having the proper carbon content. X1340 also is widely used for leadscrews. Many parts formerly made of the SAE 1000 series, such as 1015, 1045, etc., now are made from the X1300 series with marked improvement in machining conditions. Such steels as SAE 1020, 1040, etc., possess poor machining qualities, usually being too soft, which results in torn surfaces and short tool life.

SAE alloy steels, such as 3115, 4320, 4615 and 2315, in the carburizing grades, and 2340, 3140, 4140, 4340, 4640 and 6150 in the medium carbon ranges, all are in wide use and give excellent results.

There is little difference in the machining properties of these various alloy steels up to 250–300 Brinell hardness, providing that the hardness, grain size and microstructure are correct. In fact it has been our experience that alloy steels in the unhardened condition are far more dependent on grain size, hardness and microstructure for good machining than on chemical composition. Furthermore, different operations require different physical conditions in the steel in order to give desired results.

In general, roughing operations in screw machines, where high speeds and long tool life are important, require a spheroidized structure of fairly low hardness. Figs. 1 and 2 illustrate a case where SAE 6150 was considerably improved for screw machine work by a spheroidizing anneal. Fig. 3 shows the microstructure of a lot of 4140 which was impossible to thread in an automatic screw machine, using self-opening die heads, although the steel was entirely satisfactory for single point lathe threading. Fig. 4 shows the same steel after receiving a special normalizing treatment with controlled cooling.

Fig. 1—A 2⅛-in. round SAE 6150 steel bar, as received in the annealed condition, with a Brinell hardness of 205. This steel caused rapid wear on form tools in screw machines. Magnification 1000×. Fig. 2—The steel shown in Fig. 1, after being given a spheroidizing anneal. It has a Brinell hardness of 169–172. Steel in this condition worked satisfactorily in screw machine operation; approximately 600 percent longer tool life was obtained. Magnification 1000×

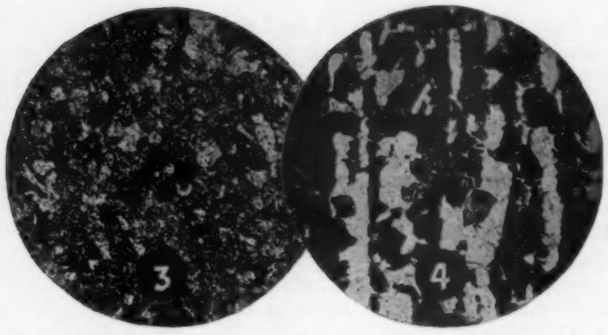


Fig. 3—An 1⅛-in. round bar of SAE 4140 steel, as received in the annealed and cold drawn condition, with a Brinell hardness of 187 gave difficulty in the die threading operation in an automatic screw machine. Magnification 1000×. Fig. 4—A 1⅛-in. round SAE 4140 steel, after having been given a special normalizing treatment to improve its machinability, gave satisfactory tool life and finish in the threading operation. The Brinell hardness is 170. Magnification 100×

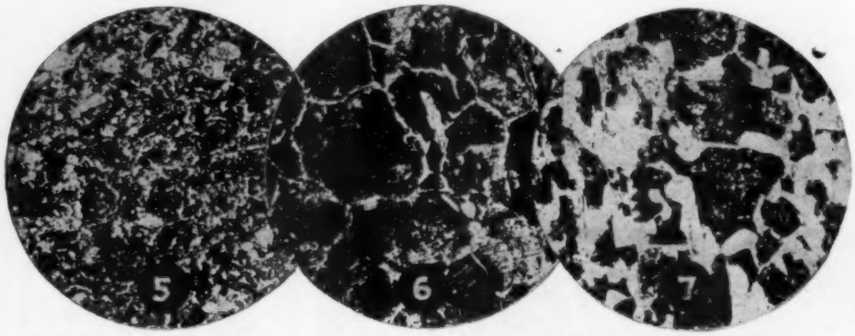


Fig. 5—A fine grained SAE X1340 steel, 2-in. round, as received in the cold drawn and annealed condition, with a Brinell hardness of 207. This steel gave trouble in the turning operation. Fig. 6—Coarse grained SAE X1340 steel 2¼-in. round, cold drawn with a Brinell hardness of 217. This is the normal cold drawn condition of this material, and it machines satisfactorily. Fig. 7—A coarse grained SAE X1340 steel, 5-in. round hot rolled. Brinell hardness is 187. The structure is satisfactory for all around machinability. All magnification 100×

In this condition the material was satisfactory for die threading; better finish and longer tool life were obtained.

In the higher Brinell ranges there seems to be an increasing demand for alloy steels containing molybdenum, such as SAE 4340. Parts made of this steel and treated to as high as 400 Brinell are being successfully machined in aircraft engine and propeller plants.

The grain size of steel as revealed by the microscope has much to do with its machining qualities; Brinell hardness tells only part of the story. Inherently coarse grained steels have better machining properties than the finer grained steels, resulting in smoother finishes, longer tool life and higher production speeds. Figs. 5, 6 and 7 show three different microstructures of SAE X1340 steel, while Figs. 8 and 9 show fine grained and medium grained SAE 3115. In each of these cases the fine grained steels were not so good for the ordinary turning, milling, boring and reaming operation as those having a larger grain size. The coarse grained steels usually harden deeper than the finer grained material, with resultant greater distortion, less ductility and at times cracking during the heat-treating operation. As a compromise many large users of plain carbon and alloy steels specify the desired grain size with resultant satisfactory machining and hardening properties.

Stainless steels, either the 12–14 percent chromium, or the 18–8 chromium-nickel grades, are difficult to machine on a commercial basis. The introduction of free machining stainless steel, as a result of the addition of the proper amount of sulphur or selenium to the melt, has resulted in the satisfactory production of many parts, formerly made of regular stainless steel grades, from these free-machining stainless steels. These free-machining grades offer the same resistance to corrosion for the majority of applications as the original stainless steels.

High carbon-high chromium steel finds wide use for long service blanking dies and punches, lamination dies, plastic dies machined to shape, thread-rolling dies, plain slitters or rotary shears and parts where high wear resistance is desired. Where stainless steel sheets are used, the high carbon-high chromium steel blanking dies give remarkable service. This high alloy steel presents considerable difficulty in machining, regardless of the microstructure or Brinell hardness. The 1½ percent carbon, 12 percent chromium type is somewhat freer machining than the higher carbon grade but leaves a lot to be desired as far as good machining properties are concerned.

The so-called air-hardening steel containing 1 percent carbon and 5 percent chromium is less difficult to machine than the high carbon-high chromium, and its popularity has increased greatly during the past couple of years.

Leaded steels have been tested carefully for machining properties recently; many investigators report that they are an improvement. It is claimed that SAE 1112 steel containing approximately 0.2 percent lead is as readily machinable as the X1112 grade. Plain carbon steels such as SAE 1020 and 1040 with lead are said to fall in the free-machining class; some types of alloy steels also benefit by the addition of lead. The physical properties of leaded steels are comparable with steels of similar composition but without the lead addition.

Lead in the form of shot is introduced in the stream of metal as it is poured into the mold, necessitating the use of special ventilating equipment

because of the possibility of lead poisoning. With proper melting practice, the lead is uniformly distributed throughout the metal. Lead, submicroscopic in size, is sprinkled all through the matrix, breaking up the continuity of free iron areas, resulting in broken chips during machining and therefore reducing frictional heat. This is of great importance in the lower carbon grades, where iron areas predominate and usually result in a material that will machine to a long "hay bale" chip, tear under machining or permit a "bug" to be picked up by the tool, resulting in short tool life and a rough finish. Undoubtedly we will hear more of leaded steels when the mills again are operating on a more normal basis.

The success or failure of many machining operations is dependent on the type of cutting fluid employed. Soluble oils, sulphur base oils, paraffine oil, lard oil, kerosene with or without addition of paraffine or lard oil, all find wide use. In visiting scores of industrial plants during the past couple of years, we have found this or that type of sulphur bearing oil being used on many operations where soluble oil formerly was used, with resultant longer tool life and smoother machined surfaces. Kerosene containing some paraffine oil or a small amount of lard oil is being used successfully as a cutting fluid for all types of machining operations on aluminum and magnesium castings as well as on some die-casting jobs. Usually a disinfectant is added to prevent skin infection.

The addition of carbon tetrachloride to cutting oil, especially sulphur base oil, results in a remarkable improvement in machining qualities, especially on difficult operations. Because of the volatility of the carbon tetrachloride, it does not find ready application, as many operators are adversely affected by the fumes. Undoubtedly a stable chloride that will give comparable results to carbon tetrachloride will some day be on the market. Some work is now being done with hexachlorethane, a stable chloride, 1 or 2 percent being added to the cutting oil.

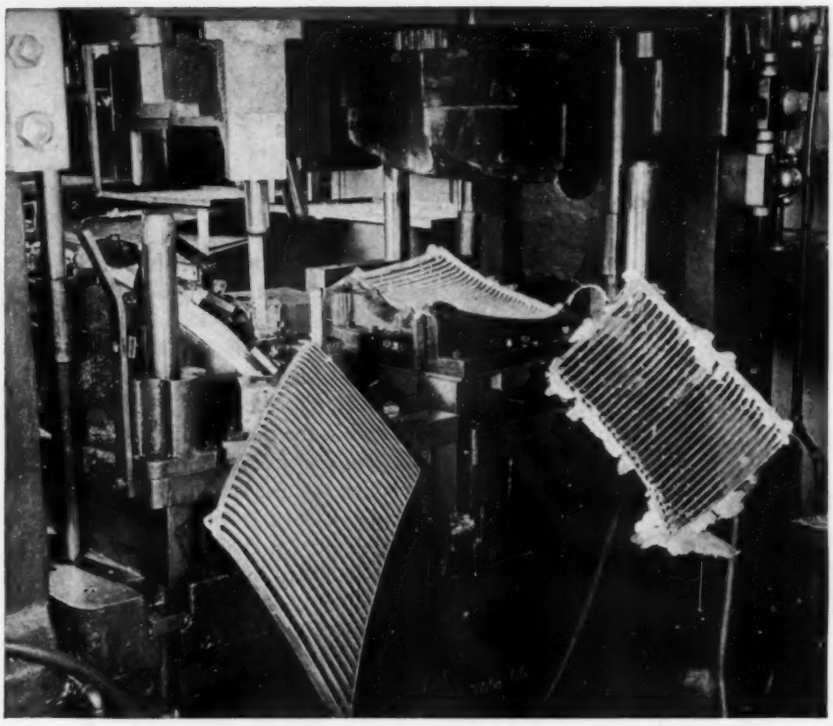
Dr. Hans Ernst, of the Cincinnati Milling Machine Company, has clearly shown one function of carbon tetrachloride as a cutting field in his remarkable motion picture study of chip formation, with pictures taken through a microscope. Whereas a marked built-up edge is noted when ordinary cutting fluids are employed, carbon tetrachloride results in reducing the adhesion between chip and tool, and prevents the built-up edge.

Fig. 8—Fine grained SAE 3115 1⅜ in. round stock with a Brinell hardness of 163. This material had poor machining properties. Magnification 100×. Fig. 9—Medium grain size SAE 3115 1⅜-in. round stock with a Brinell hardness of 156. In this condition the steel has good machining properties. Magnification 100×

It's not enough to use the correct grade of cutting fluid, the stream must be properly directed in relation to the tool and work. Here is the application of a soluble oil to a 10-in. gear grinder

It is not enough merely to use the correct cutting oil. The cutting fluid must be properly directed on the tool and work and in sufficient volume to accomplish the desired results. The function of cutting fluids is to cool the work piece at the point where chip is being formed, and also to reduce adhesion between chip and tool face.

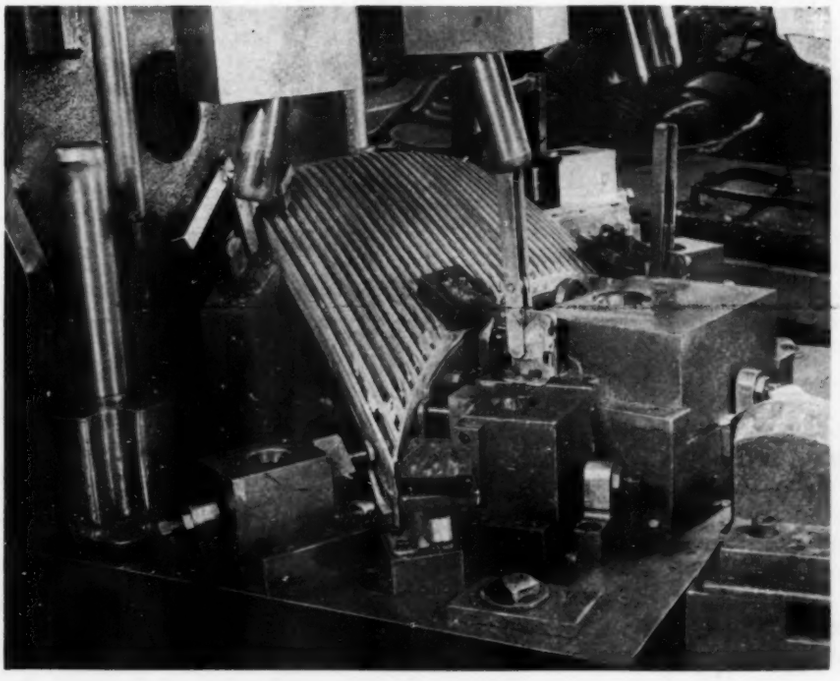
The Independent Research Committee on cutting fluids, formed some four years ago, has published several reports in cooperation with some of the technical societies of this country. Two fundamental projects are now being studied by this committee made up of educators, representatives of oil companies and industrialists. One of these is concerned with the production of a standardized "reference" material to be used by investigators in the field of metal cutting. The second project deals with the simplification of cutting fluids used by industry, and aims at the standardization of nomenclature by defining the character of the commonly used cutting fluids. Much good should accrue from this work.



The rough casting at the right is trimmed in the right hand die section and perforated at the left

Grilles for the Mercury

BY HERBERT CHASE



ONE OF SEVERAL die cast radiator grilles produced in large quantities by the Doehler Die Casting Company is that used on Mercury cars. As the casting is of zinc alloy, which is highly resistant to impact stress, the flash between bars and around the contour is trimmed in a heavy punch press. Fastening holes are punched in a supplementary operation in another section of the same die as it is not convenient to core these holes in the casting. These operations are much the same as they might be if the grille were a stamping, but the shape is such that the grille could not be stamped and its finished appearance is considered superior to that of a stamped grille. The grille is subsequently plated.

As with all die castings, considerable flash is formed at the die parting; the first operation after breaking off the sprue is to shear the flash. This is accomplished in the first section of the duplex die.

The second die section uses several cam-operated slides each of which carries one or more punches. Toggle clamps are used to fasten the grille in place, and when the die is closed, the angular pins in the upper section enter corresponding holes in the slides and advance them along with the punches they carry. There are ten holes at different angles, and although they might be cored when the casting is made, this would make the casting die complicated and expensive. Also, if a core pin were broken or bent, the die and machine in which it is used would be out of operation until a repair could be effected.

The fastening holes could be drilled as another alternative, but since the zinc alloy admits of punching and since a punch press operation is required for trimming flash anyway, the quickest and least expensive operation is to punch the holes. Two men operate the press, one handling the grille in the trim section and the other putting it through the punching section. In all, 125 to 150 grilles are passed through the dies an hour.

The pair of dies shown are used for doing these operations on only one half of a complete grille, which is made up of right and left halves. After a given number of right halves are put through, dies are changed for another pair for trimming and punching the left half. Each half grille weighs only 4.2 lb., hence the complete grille is less than a third as heavy as some die cast grilles produced in past years.

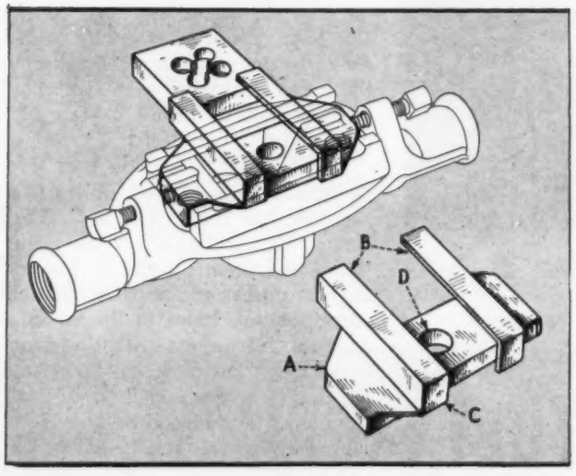
Angular pins serve as cams to advance the punches after the grille is secured with toggle clamps

IDEAS FROM PRACTICAL MEN

Adapts Die Stock for Square Dies

By W. E. ABBOTT

The inconvenience of using a square die for running thread on pipe or solid stock can be overcome by adapting the illustrated square-die holder to the conventional stock for holding split dies. The adapter



An adapter to fit a standard die stock can be designed as shown to hold square dies, thereby overcoming the inconvenience when using these dies

A is milled from solid stock and is drilled centrally for passage of the material to be threaded. Guides *B* are fitted with stops *C* so located to position the die centrally above the hole *D* in the adapter. The height of the guides can be made sufficient to take the biggest die, and shims can be provided for thinner ones.

As shown in the illustration, the adapter fits into the die stock in the space provided for the split dies, and is centralized in the customary manner by the setscrew.

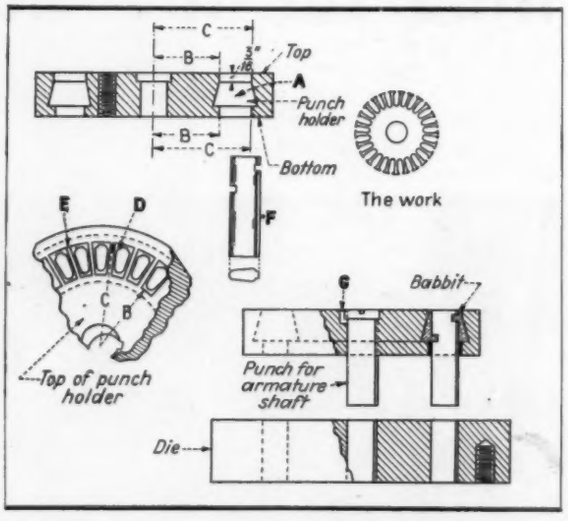
Punch Holder for Armature Dies

By GEORGE J. MURDOCK

The soft-iron laminations used in building the armatures of electric generators and motors are usually produced by compound or combination dies. The punches that blank out the spaced holes on the periphery for the copper wire are held in line with holes in the die by a circular steel disk that is attached to the moving member of a pillar subpress. The common method of laying out and cutting the holes through the holder which receive the punches has been almost as costly as the work on the die. It was to reduce this cost that the holder here described was designed. The construction of the dies of this class is well known, and only the way of securing the punches is given.

The blank for the punches is first fitted with the punch which blanks the hole for the armature shaft. This punch is then inserted in the die until the holder is in contact with its upper surface. The contour of each hole in the die is scribed on the coppered surface of the holder. The holder is then chucked with the top face outward in a lathe and a channel is turned concentric with the center punch to within $\frac{3}{16}$ in. from the faceplate. This channel is then widened as shown at *A* in the drawing. Radii *B* and *C* are then transferred to the bottom of the holder. The area inclosed between radii *B* and *C* is then drilled and filed, leaving the holes shaped as shown at *D* with partition *E* between each one.

The die and its accessories, such as knockouts or strippers, is now assembled on the base of the subpress. The punches *F* with two notches on opposite sides, as shown, are tapped gently into the die until their tops are even with the top of the punch holder



The punch set for making armature laminations can be assembled quickly and cheaply by positioning the punches accurately in oversize holes in the holder and retaining them by babbitt

when it is in place. The holder is then located over the die and so positioned that the small punches are at substantially equal distances from the holder walls. With the holder properly located, a steel key *G* is inserted to prevent it from turning. Two parallels are then inserted between the die and the holder, leaving

the large central punch inserted in the die about $\frac{1}{2}$ in.

The top member of the subpress is then doweled lightly to the holder and both parts removed, together with the parallels. The small punches are numbered to correspond to their proper places in the die, and are removed. A piece of $\frac{1}{32}$-in. asbestos is pasted to the top of the die, and when nearly dry it is pierced at the holes with a punch made of solder. The punches are then reinserted in the die and the holder lowered down onto the asbestos. The holder assumes the exact position previously established, since the central punch has been keyed by pin *G* and is fitted with the rib for forming the armature shaft keyways in the laminations.

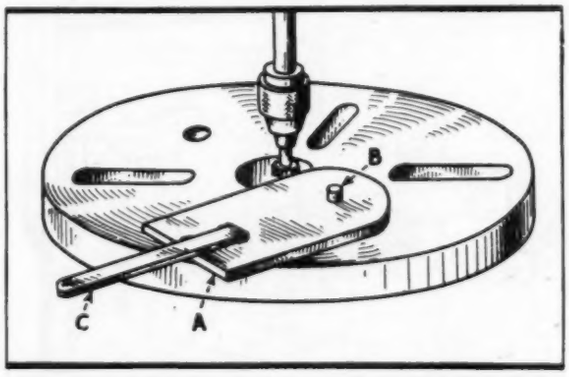
The subpress, die and holder are then placed in a large pan which is filled with water up to the top of the die. The rim of the holder is then heated until the water boils. A good grade of babbitt is then poured around the top of the punches. A dam of fireclay should be built around the channel in the top of the holder to prevent the hot metal from running over into the water. The thin asbestos on top of the die prevents any of the metal running through around the punches, and it usually is moist enought to prevent the babbit from drawing the temper of the top and cutting edges of the die.

When cold and removed from the pan, the top member is doweled properly in position, and the remaining assembly completed. The unit is then ready for use after the usual grinding of the punch and die faces and removal of any surplus babbitt on the top of the holder. While this method has been used chiefly on comparatively small dies, the results obtained seem to justify the belief that it can be used successfully on any size of die for punching thin metal where the power required to blank is not great.

Drill Press Serves as Miller

By J. J. REICH

The set-up shown in the illustration for milling a 4-in. radius on the $\frac{1}{2}$x8x16-in. steel plate *A* was adopted because other machines were not available.



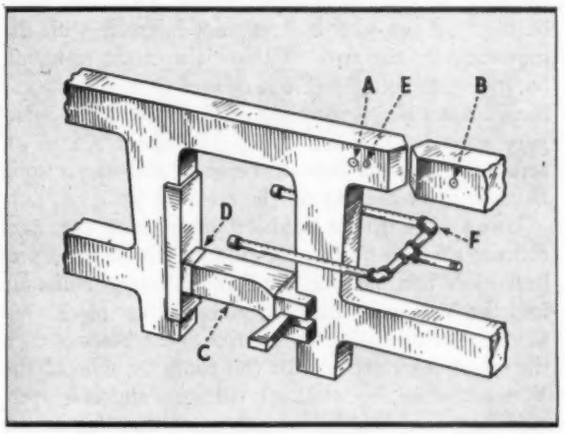
The semi-circular end of this steel plate was milled by bolting the plate to a drill-press table, and rotating the plate against the cutter in the spindle

A $\frac{1}{2}$-in. hole *B* was drilled on the center line of the semi-circular end of the plate, by means of which the plate was bolted to a drill press table. The handle bar *C* was tack welded to the plate as shown, and was used to feed the plate against the cutter. After the work was located and the drill press table locked, the plate was rotated against the milling cutter inserted in the drill-press spindle.

Recommends Method for Welding Frames

By ARTHUR HAVENS

Frame welding is one of the principal operations in the railroad welders repertoire, and requires exceptional skill both in the welding and in the preparation. The contraction of a frame after welding is compensated for by expanding or spreading the frame the required amount before scarfing and welding. The



When welding locomotive frames, a machined frame spreader and accessories to protect the welders from the heat speeds the work. The latter includes a face shield suspended in front of the welder, an air cooler, and a cone-shaped shield attached to the welding torch

first duty of the welder is to place tram marks *A* and *B* on the outside of the frame, keeping each center punch mark far enough away from the reinforcement of the weld so that it will not become obliterated. When the tram marks are made, the frame is checked for alignment and necessary adjustments made. The next step is to expand the frame the amount it will contract after welding—a 6x12-in. frame will require $\frac{11}{32}$ in. expansion, while 5x6-in. and 4x4-in. frames will require $\frac{1}{4}$ and $\frac{5}{32}$ in. expansion, respectively.

The easiest way to secure this expansion is to insert a slow wedge frame spreader *C* and block *D* between the pedestal jaws in line with the bottom rail of the frame. Stressing at this location will push the frame apart the required amount. Record the expansion with center-punch mark *E*.

The break is now ready for scarfing. Usually, an experienced operator will cut the frame without laying

it out, but it is always safer to center punch a mark on the frame where the cut is to be made. The width of the Vee depends a good deal on the welder, since different operators desire different openings; however, a happy medium is a 60-deg. included angle. The Vee should be smooth, free from deep pockets that might hold oxide, and finally cleaned thoroughly.

Welding can be facilitated by protecting the operator from the intense heat and flying particles of oxide and grit that are ever present when welding a frame with two torches. An excellent accessory is a U-shaped air cooler *F* made from lengths of 1-in. pipe about 2 ft. long with a series of $\frac{1}{8}$-in. holes drilled on 1 in. centers. The joints where the long legs of the U join the elbows are left loose so that the operator can turn them to best suit his needs.

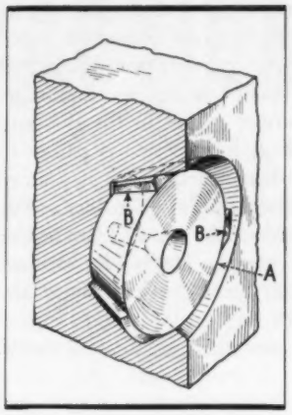
Another protective device is a 12x24-in. 20-gage sheet-metal face shield with an opening for an 8x10-in. glass held in place by light flanges riveted or brazed to the shield. This shield is hung in front of the operator so that it will protect his face, but must be high enough so that it will not interfere with the movement of his arms. Canvas gloves are essential, but these are often not enough to protect the torch hand. A simple hand shield can be made from light-gage sheet metal rolled into a cone about 5 or 6 in. across the top; the hole in the small end of the cone is made to fit the nut on the welding tip.

Using large tips in the blow pipes, both operators concentrate their heat on the sides of the frame to preheat it. When red hot, the flame is brought directly into the Vee and a washing process takes place. All oxide is washed off from the top to the bottom, then the excess is melted off. By this time, the sides of the Vees are white hot sweating surfaces, and one operator starts welding in the center of the Vee at the bottom, while the other continues to heat his side of the frame until a bridge is built, so that he can bring his torch into the Vee and start welding. As the weld progresses, the operators alternate in placing metal into the center, for if both tried to weld in the center at the same time the tips will overheat and require frequent cooling. The reinforcement should be shaped as the weld advances, and should be about $\frac{1}{2}$ in. thick in the center and rounded out to the width of the frame about 1 in. each side of the scarf. As soon as the weld is completed, the frame wedge should be driven out of the expander, thus relieving the strain and allowing the frame to assume its normal length as the weld cools.

Centering Block for Chucking Large Castings

By MARTIN H. BALL

The centering block *A* shown in the drawing was first made for centering and steadying the free end of a casting when chucked in a lathe. This casting required facing on the centered end, was of such shape that a steadyrest could not be used, and was of such length that it needed support when chucked in the lathe. The block was afterwards found to be applicable to several jobs.



A tapered block with three equally spaced ribs can be used for centering and steadying the free end of a long casting chucked in the lathe

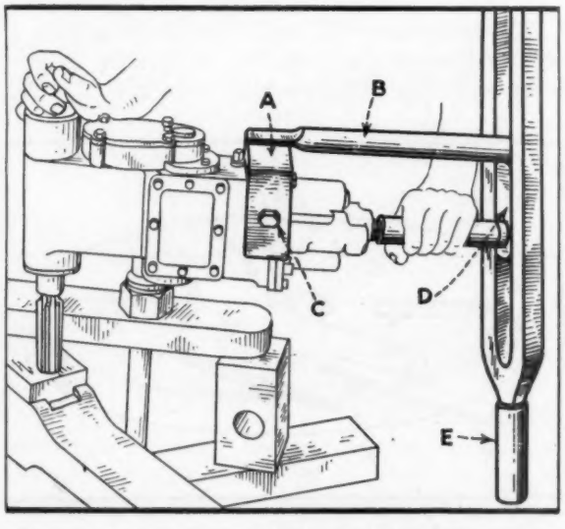
The block is made of high carbon steel and is hardened. It has three equally spaced ribs *B* on its outer edges by which it centers itself in the cored hole of a casting without rocking, even though the rough cast pocket cored in the casting is neither smooth nor true.

The tailstock center holds the block to its seat in the casting.

Frame Holds Corner Motor for Reaming Rods

BY NOAH DEERING

The head mechanic in our valve department found it necessary to use frequently a corner motor for reaming valve motion rods. In order to facilitate this work, he mounted a corner motor on the valve bench with the permanent arrangement shown in the illustration. It consists of a piece of $\frac{1}{4}$x2-in. steel *A* formed into a U to fit over the end of the corner motor. To this U-frame is welded arm *B* made from $\frac{3}{4}$-in. standard pipe flattened on one end. This assembly is bolted to the motor with studs *C*. Welded to arm *B* is spacer *D* which is of sufficient length to slip over the handle of the motor, keeping arm *B* and the motor handle parallel. This spreader fits the slot in yoke *E* set vertically in the bench.



To minimize the handling of locomotive valve-motion rods, they are reamed by a corner motor prevented from turning by this arrangement

Armament
SECTION OF AMERICAN MACHINIST

TOOLING SET-UPS FOR HIGH EXPLOSIVE SHELL—V

BY BEN C. BROSHEER
Associate Editor, American Machinist

THE LODGE & SHIPLEY No. 3A × 27 in. Duomatic lathe is tooled as shown in Fig. 128 for turning the band on 105-mm. high-explosive shell bodies. In this arrangement, the base end of the shell body is located and supported in an air-operated three-jaw universal chuck having special false jaws. The nose end is supported by a special built-in revolving tailstock center. Using either high-speed or carbide-tipped tools, this set-up rough and finish turns the outside diameter of the band with two tools mounted on the front carriage. A third tool on the front carriage forms the taper at the front end of the band after the finish turning tool has completed its cut. Then, two tools on the rear slide rough form the shoulders at each end of the band. After this roughing cut the operator uses an over-head toolholder with hand feed to finish form the shoulders. Speeds, feeds and production rate are dependent upon the cutting material selected and the ability of the operator to load and unload the machine.

For the 155-mm., M-102, high-explosive shell, a tooling layout like that shown in Fig. 129 is suitable when turning the rotating band in a No. 3A × 39-in. Duomatic lathe. This set-up is quite similar to the

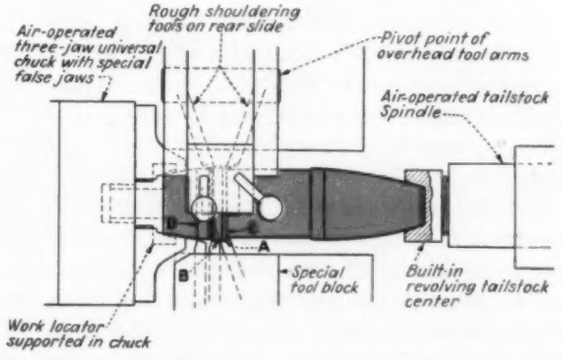

Rough shouldering tools on rear slide
Air-operated three-jaw universal chuck with special false jaws
Pivot point of overhead tool arms
Air-operated tailstock Spindle
Special tool block
Built-in revolving tailstock center
Work locator supported in chuck

Fig. 128—A No. 3A × 27 in. Duomatic lathe with this tooling arrangement permits rapid, accurate turning of the rotating band on 105-mm. shell

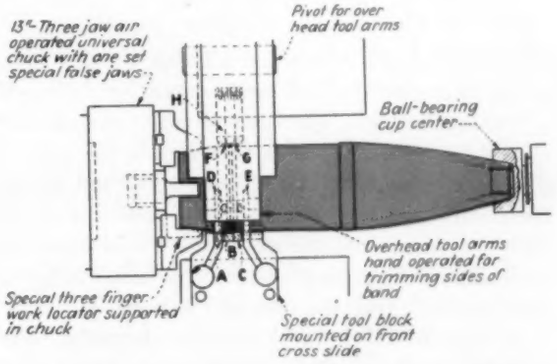

13"-Three jaw air operated universal chuck with one set special false jaws
Pivot for over head tool arms
Ball-bearing cup center
Overhead tool arms hand operated for trimming sides of band
Special three finger work locator supported in chuck
Special tool block mounted on front cross slide

Fig. 129—A forming tool is added for grooving in this set-up on a No. 3A × 39 in. Duomatic lathe for turning the band on a 155-mm. shell

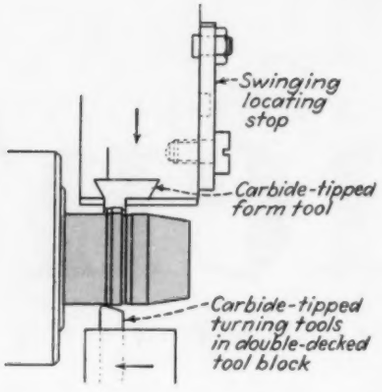


Fig. 130—Three carbide-tipped tools rough and finish turn and form bands on 75-, 90-, 105- and 155-mm. shell on a Gisholt No. 12 automatic lathe

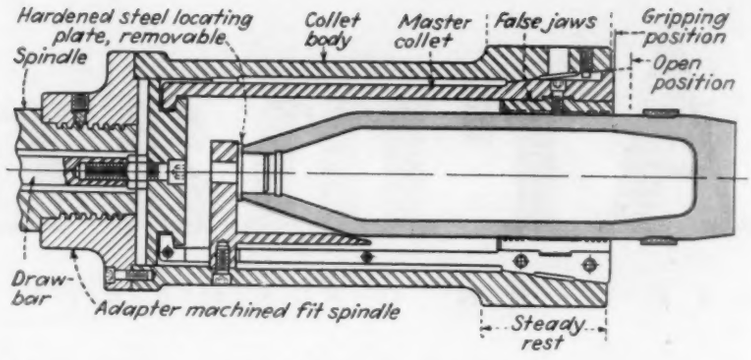


Fig. 133—This Logan parallel grip collet chuck can be used for all base-end operations on shell up to 6-in. diameter. It is supported by a steadyrest

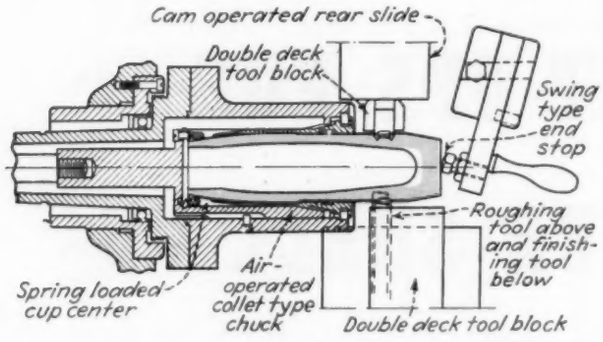

Cam operated rear slide
Double deck tool block
Swing type end stop
Roughing tool above and finishing tool below
Air-operated collet type chuck
Spring loaded cup center
Double deck tool block

Fig. 131—Cutting speed is 420 ft. per min. with this set-up on a Sundstrand Model 8 lathe for turning and forming the rotating band on 75-mm. shell

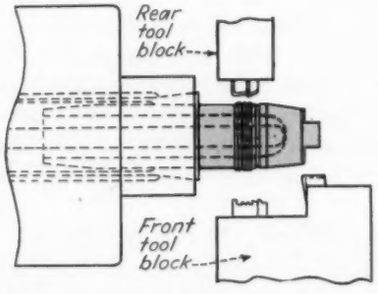


Fig. 132—Facing off of the base end of the 90-mm. shell was combined with the band turning operation in this set-up on a Blood shell lathe

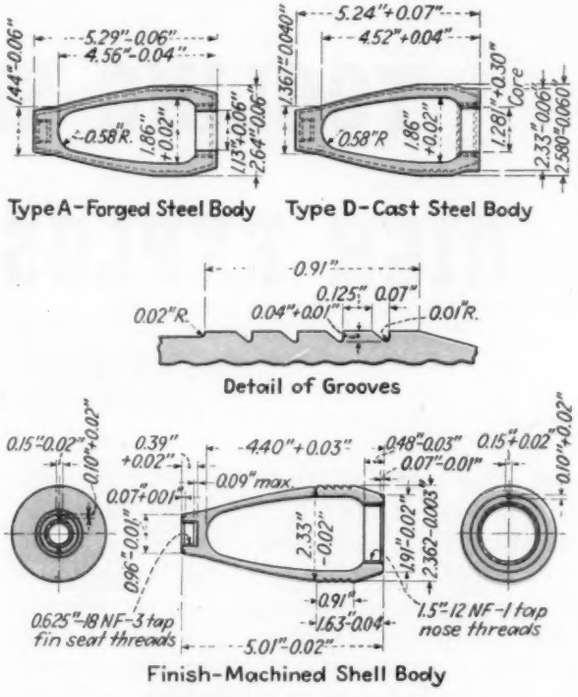


Fig. 134—The bodies for the 60-mm. high-explosive shell used in smooth-bore mortars can be made from steel forgings, steel castings, or special rolled sheet, cupped and welded along the seams. Similar European shell have been made in large quantities from fine-grain cast iron. The cavity is not machined

set-up in Fig. 128, except that a forming tool is added to the tooling on the back arm for turning the groove in the band. Here, the band is rough turned with tool *A*, finish turned with tool *B* and the taper is formed with tool *C*. Then, tools *F*, *G* and *H* face the sides of the band and form the groove when the back arm is fed into the work. As a final operation, tools *D* and *E* on an over-head tool arm are fed by hand to finish trim the sides of the band.

A Gisholt No. 12 hydraulic automatic lathe equipped with a special air-operated collet chuck supported in a ball-bearing steadyrest requires only simple tooling for turning and forming the band on 75-, 90-, 105- and 155-mm. shell. The set-up for this operation is shown in Fig. 130. In this layout the shell is chucked while positioned longitudinally by a swinging stop on the rear tool slide. Two carbide-tipped tools in a double-decked tool block on the front slide rough and finish turn the band at 350 ft. per min., then the rear tool slide is fed forward and the single dove-tailed form tool, which also is carbide tipped, finish forms the copper band and trims the edges. Where the band requires grooving, as in the 90-mm. shell, this form tool is ground to produce these grooves while the other forming is being done. Estimated floor-to-floor time for one piece is 0.5 min.

for the 75-mm. shell, 0.8 min. for the 90- and the 105-mm. shell, and 1.5 min. for the 155-mm. shell. In each of the set-ups, the lathe is driven with a 10 hp. constant speed motor.

Shown in Fig. 131 is the tooling layout for turning and forming the copper band on a 75-mm. high-explosive shell on a Sundstrand Model 8 single-spindle short bed lathe. The part is held in an air-operated collet type chuck which grips the outside diameter of the shell adjacent to the cut. The nose end of the shell is supported in a spring loaded cup-type center. A swing type end stop positions the part endwise in relation to the outside of the closed end of the shell. The front carriage, which feeds longitudinally, carries a double deck tool block. In this block the roughing tool is carried in the upper position and is set approximately $\frac{1}{8}$ in. ahead of the finishing tool, which is in the lower position. Tool relief is provided for the return stroke of the tool slide. The rear slide feeds crosswise and also carries a double deck tool block. In the lower position of the rear tool block is a finish forming tool, while in the upper position are two single point tools for finishing the two sides of the band. Loading position is at the end of the machine. The machine has an automatic cycle, after loading, of rapid approach, feed, rapid return, and stop, all of which is timed and interlocked with the starting and stopping of the machine spindle and the coolant flow. Using carbide-tipped tools and a work speed of 420 ft. per min., production at 85 per cent efficiency is 123 shell per hour.

The Blood type lathe shown in Fig. 103 easily can be tooled for turning and forming the band on 75-mm. shell. The work is gripped on the outside diameter close to the band in an air-operated collet chuck, registering endwise from the finished face of the open end. One form tool in the cross slide toolholder is used to finish form the band. Usually, this is a carbide-tipped form tool, and the machine is driven with a $7\frac{1}{2}$-hp. motor equipped with a brake for quick stopping of the spindle when the operation is completed. Spindle speed usually is selected to give a cutting speed of 500 to 600 ft. per min.

In one set-up for a 90-mm. shell on the Blood lathe, facing of the base end of the shell was combined with the band turning operation as shown in Fig. 132. The two carbide-tipped tools in the rear tool block were used for rough and finish-turning the gilding metal band, while the front tool block was fed forward to face off the base end of the shell and form the band and the crimping groove with form tools, which also were carbide tipped. In this case the lathe was driven with a 10-hp. motor at 312 r.p.m., giving a cutting speed of 250 ft. per min. Estimated production was 125 pieces per hour.

In Fig. 133 is shown a parallel grip collet chuck developed by Logansport Machine, Inc., for base facing and band turning operations on shell up to 6 in. diameter. The master collet is fitted with false jaws which can be interchanged for different diameters of shell. Note that the draw-in collet forces the nose of the shell onto a hardened pin in the locating plate inside the chuck body. This plate is equipped with a shelf to facilitate loading the shell onto the locator. Chuck is designed for steadyrest support, as indicated. Each jaw opens $3\frac{3}{32}$ in., giving a total opening of $\frac{3}{16}$ in. on diameter. A 14-in. double-acting pneumatic cylinder or an 8-in. double-acting hydraulic cylinder can be used to operate this chuck.

Operations for the 60-mm. Mortar Shell

The 60-mm., M49A2, high-explosive shell for smooth-bore mortars is made in four types: (A) forged steel body, (B) body produced by cupping specially rolled WD-1020 steel plate and seam welding longitudinally, (C) body produced by cupping folded WD-1020 steel plate, inserting a steel plug in small end and seam welding longitudinally, and (D) cast steel body. Specifications and principal dimensions are shown in Tables I and II, while shape and other dimensions are given in Fig. 134.

The forging for this shell must have a maximum weight of 3.33 lb., and a maximum eccentricity between the shell cavity and outside surface at any point of 0.04 in. The forging is made from WD-X1314 steel. The cast body has a maximum weight of 2.90 lb., and is permitted to have a maximum eccentricity between the cavity and the outside surface at any point of 0.045 in. The casting must withstand an internal air pressure test of 250 lb. per sq. in., and the cavity must be free from scale, pits, seams, laminations, cracks, blowholes, pockets, sand or other imperfections. Finish of the cavity surface must be equal to that of a finish bored cavity. Capacity of the cavity as cast must be approximately 8.85 cu.in.

The following maximum eccentricities of cylindrical surfaces will be accepted: (1) between the nose threads, fin seat threads and outside cylindrical surfaces, 0.01 in.; (2) between the cavity of the shell and outside cylindrical surfaces, 0.015 in. The threaded hole at the fin-seat end is 0.625-18NF-3 with a minimum major diameter of 0.6250 in., a pitch diameter of 0.5889 + 0.0030 in., and a minor diameter of 0.5649 + 0.0076 in. The 1.512NF-1 threaded hole at the nose end has a minimum major diameter of 1.5000 in., a pitch diameter equal to 1.4459 + 0.0079 in., and a minor diameter of 1.4098 + 0.0090 in. These 60-mm. mortar shell are identified by stamping on the circumference of the body

1.0 in. to the rear of the bourrelet with $\frac{1}{8}$-in. letters and figures the lot number of the shell, year of manufacture, initials or symbol of manufacturer, and caliber and designation of the shell.

As with other high-explosive shell, this mortar shell can be machined in a number of differing ways. In Fig. 135 are shown the operations performed at the different stations of an 8-in. eight-spindle Type D Bullard Mult-Au-Matic, which is tooled for practically all operations on this shell except the threading of the small end for the fin seat. This is a double indexing machine, operations on the small end and the outside diameter being performed during the first chucking, then the shell is inverted and the operations at the large end are done in the second chucking. First, the shell is chucked on a special power operated fixture at station 2. Then, the small end is drilled and the outside diameter is rough turned at station 4 as indicated. Drilling speed is 65 ft. per min. with a feed of 0.0085 in. per rev. At the sixth station the small end is finish bored and faced with a multi-blade cutter, while the outside diameter is finish turned at the bourrelet. Finally, the shell is indexed to the eighth station where the small end is finish faced, undercut and chamfered while the bourrelet grooves are being form turned and chamfered. During the first chucking, the fourth station is rotated at 280 r.p.m., the sixth station at 264 r.p.m., and the eighth station at 122 r.p.m.

Upon return to the second station, the shell is removed from the fixture, inverted and placed in a power-operated three-jaw chuck at station 1 for the second chucking. When indexed to the third station, the large end is rough bored, faced and taper turned at 233 r.p.m. At station 5, these same surfaces are finished and the large end is chamfered. Here, the work is revolved at 247 r.p.m. Finally, the large end is tapped with a collapsible tap fed with a positive lead cam. Then, when the piece has been indexed from the seventh station to the first station, it is unloaded to a conveyor for delivery to a threading machine where the small end is tapped. Estimated production with this Bullard set-up is 80 pieces per hour when using high-speed steel tools. This estimate is based on the ability of the operator to load and unload two pieces in 19 sec., and on removing an average amount of stock.

The Model 86 eight-spindle New Britain-Gridley chucking machine equipped for double indexing is well adapted for operations on 60- and 81-mm. mortar shell. However, in this case a preliminary center-drilling and turning operation is necessary. In the tooling layout for a 60-mm. mortar shell shown in Fig. 136, four of the spindles are equipped with three-jaw hydraulically operated collets and four alternate spindles have threaded drawback arbors. The shell bodies are loaded by means of a hand operated loading ram contacting the bottom of the cavity to locate the bodies in the chucks. A spring actuated block inside each chuck contacts the drilled center hole at the small end of the shell, thus applying pressure against the loading ram, and centering the body in the chuck. A gross production of 146 pieces per hour for 60-mm. mortar shell is estimated for the set-up shown in Fig. 136, when using high-speed steel tools and a spindle speed of 206 r.p.m.

The shell body first is chucked at station 8, then shifted to station 2 where the large end is rough formed, faced, counterbored and chamfered. Next, the large end is finish counterbored at station 4, then formed and tapped at station 6. Upon return to station 8 the shell body is removed and loaded on a threaded drawback arbor at station 1. At station 3 the bourrelet is turned and the small end is drilled, using a 3-to-1 drill speeder. Next the small end is counterbored, faced and chamfered and the bourrelet is form turned at station 5. A 3-to-1 drill speeder is used at station 5 for the combination counterboring, facing and chamfering tool. Finally, at station 7 the hole in the small end of the shell is recessed with a high-speed steel tool.

Where single-spindle machines are to be used centering is an important operation, since maintenance of concentricity in following operations depends upon the accuracy of the centering operation. Shown in Fig. 137 is a tooling set-up for centering the 60-mm. and the 81-mm. mortar shell on a special "Carbo" centering lathe made by W. C. Lipe, Inc. The part is chucked on an expanding three-key arbor operated by an air cylinder, the bottom of the cavity being centered on an extension of the arbor. Like many of the centering lathes used for 75- to 155-mm. shell, this lathe has a motor-driven centering attachment on the bed arranged to move to the rear of the bed while the part is loaded or unloaded, and then brought into line with the headstock spindle for the drilling operation. Using a 5-hp. motor to drive the machine at 305 r.p.m., production with this set-up is approximately 50 pieces per hour for either size of shell. During the centering operation a carbide-tipped tool on the front carriage is used to rough turn the bourrelet of the shell, so that it can be chucked on this surface for rough boring the large end in a following operation.

After the centering operation, the 60-mm. shell can be machined in a number of different ways. Gisholt Machine Company recommends three operations, the first of which is set-up on a No. 12 hydraulic automatic lathe with a front carriage and a rear slide, using a heavy-duty air-operated tailstock with a ball

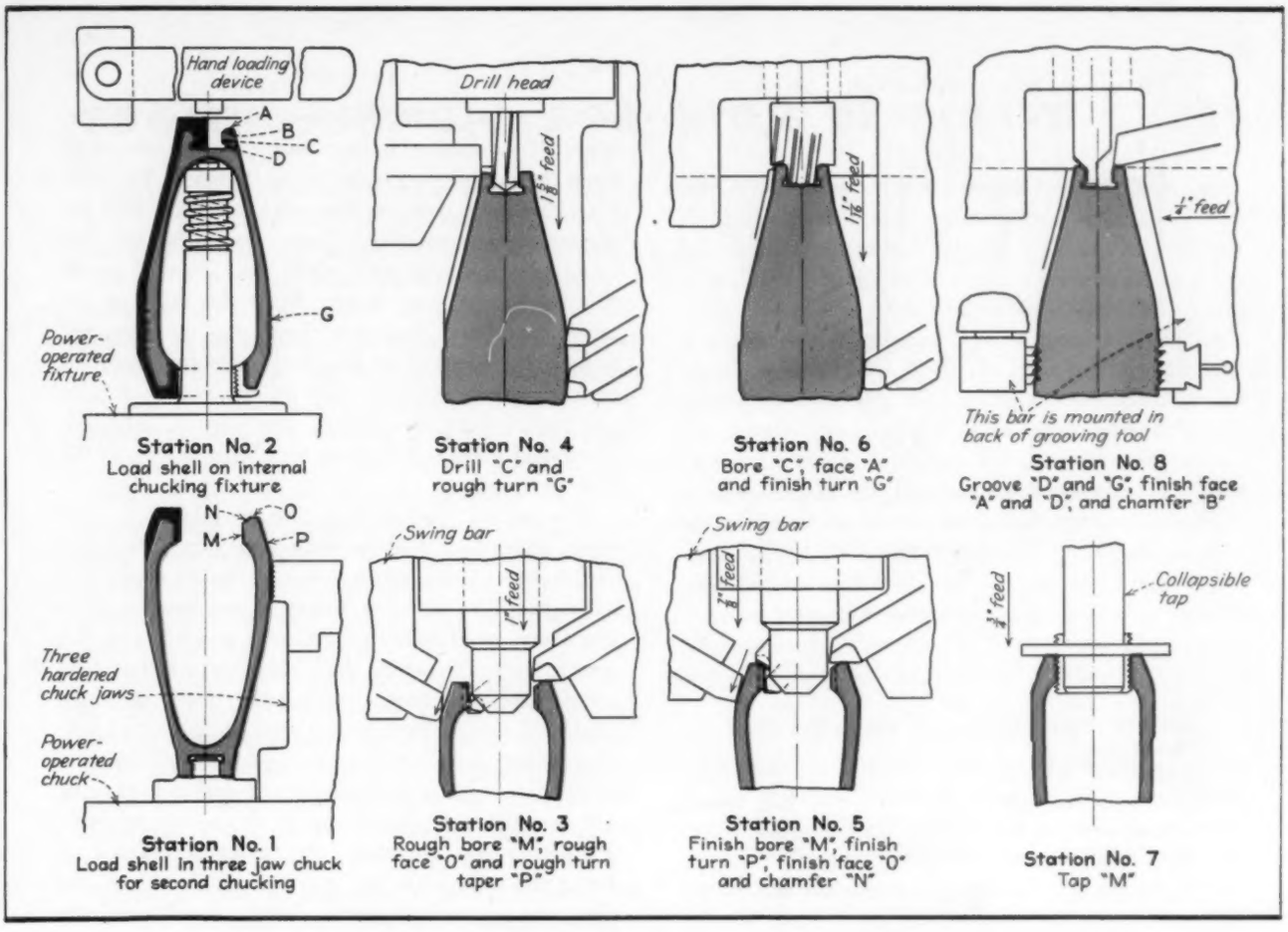
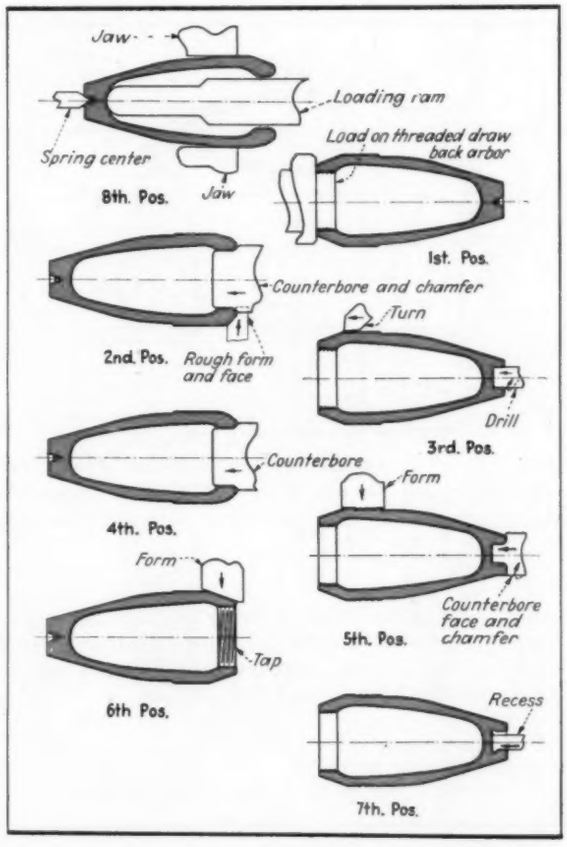


Fig. 135—Most of the operations on 60-mm. mortar shell can be done with two chuckings in an 8-in. eight-station Type D Mult-Au-Matic. Production is 80 pieces per hour

Fig. 136—Mortar shell of 60- and 81-mm. sizes are finished, except for tapping the small end, in a Model 86 eight-spindle New Britain-Gridley machine with tooling as shown below



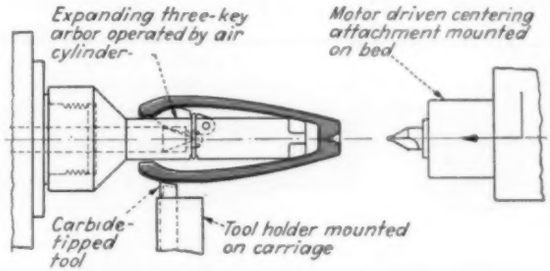
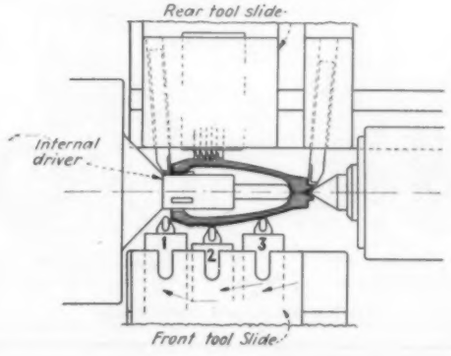

Expanding three-key arbor operated by air cylinder
Motor driven centering attachment mounted on bed
Carbide-tipped tool
Tool holder mounted on carriage

Fig. 137—The 60- and 81-mm. trench mortar shell must be centered accurately when machining operations are to be performed in single spindle machines. Almost one shell a minute can be centered and rough turned on the bourrelet with this set-up on a Lipe "Carbo" centering lathe

Fig. 138—A Gisholt No. 12 hydraulic automatic lathe with carbide-tipped tools set up as shown will turn a 60-mm. mortar shell in less than a minute



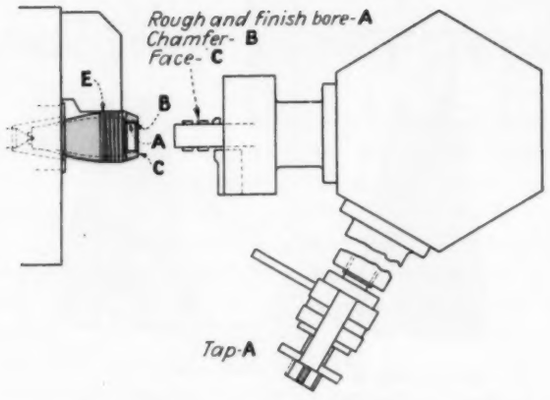


Fig. 139—After finish turning, the large end of the 60-mm. mortar shell is machined in this set-up on a Gisholt No. 3 ram-type turret lathe

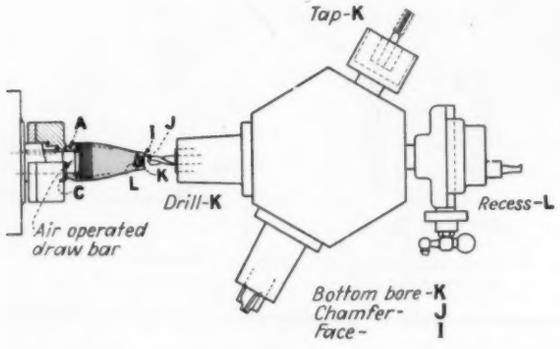
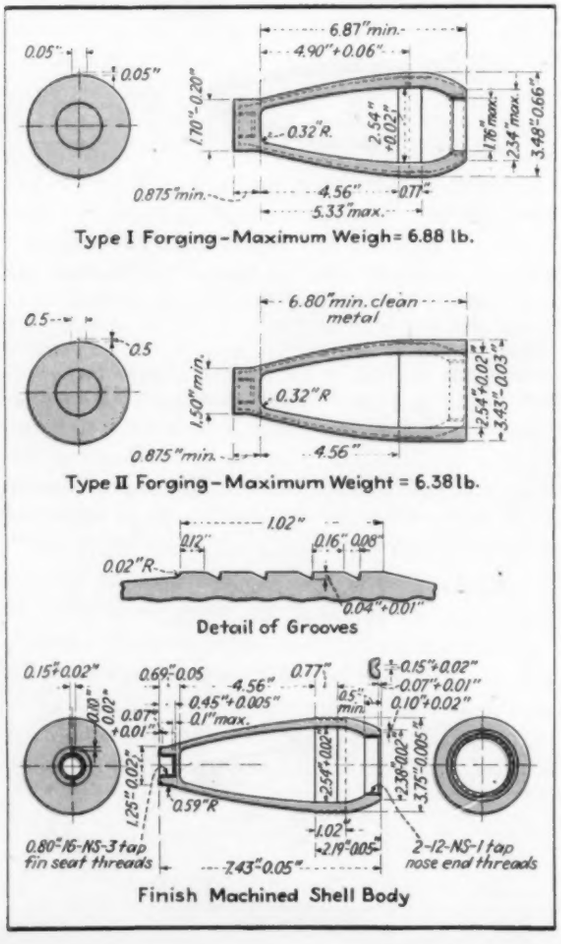


Fig. 140—Four turret stations are used for operations on the small end of a 60-mm. mortar shell in this Gisholt layout for a No. 3 turret lathe



bearing center. The shell body is held on an air-operated expanding fixture which locates the shell from the bottom of the cavity, as shown in Fig. 138. Carbide-tipped tools on the front carriage turn the outside surfaces complete. Tool 1 turns the bourrelet and tapers the large end, while tools 2 and 3 divide the cut on the long taper. After the tools on the front slide have completed their cuts, the rear tool slide is fed forward to face both ends and form the bourrelet grooves. All tools on the rear slide also are tipped with one of the steel cutting carbides. Estimated floor-to-floor time for this operation is 0.8 min. per piece.

The second Gisholt operation on 60-mm. mortar shell bodies is tooled as shown in Fig. 139 for a No. 3 turret lathe, which does not require a tool-post carriage. The hexagon turret is equipped with a threading attachment for accurate tapping. In this set-up, the finish turned shell body is chucked at *E* in an air-operated chuck, locating the small end on a center in the chuck body. Two boring cutters, one chamfering cutter and one facing cutter, all carbide-tipped, are held in the first turret position for boring the large end *A*, chamfering at *B* and facing at *C*. Following this operation the turret is indexed to bring the collapsible tap into position for threading the large end of the shell. While the No. 12 hydraulic automatic lathe used for the preceding operation required 15 hp., this No. 3 turret lathe needs only a 5-hp. motor. Floor-to-floor time per piece is 0.8 min. for this second operation.

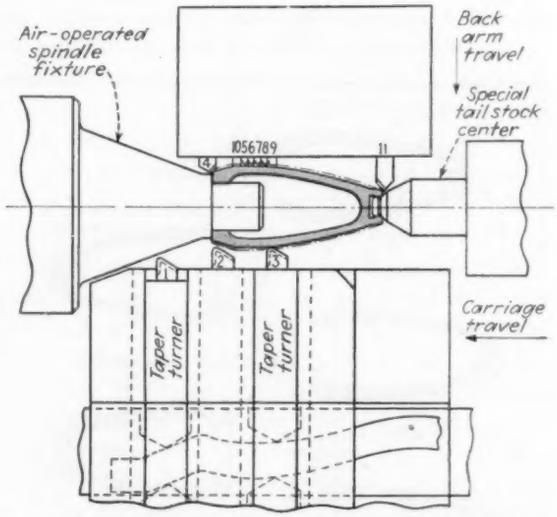


Fig. 141—The 60-mm. mortar shell can be turned in one operation on the 8 × 15-in. Fay automatic lathe, after ends are machined but not threaded

Fig. 142—Made from upset or pierced-and-drawn forgings of WD-X1314 steel, the finish-machined body of the 81-mm. high-explosive trench mortar shell weighs 3.94 lb. and has 24.0 cu. in. capacity

TOOLING SET-UPS FOR HIGH EXPLOSIVE SHELL

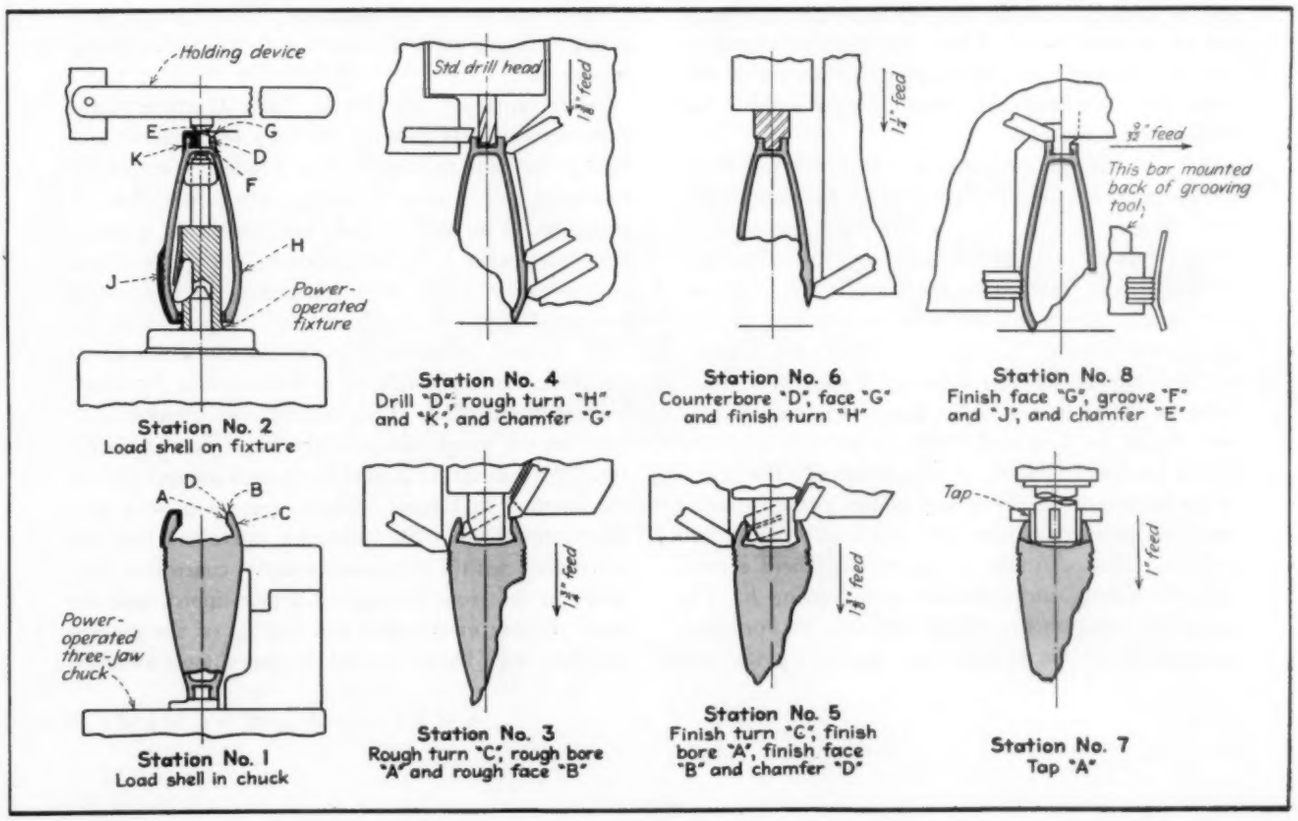
A Gisholt No. 3 ram-type turret lathe also can be used for operations on the small end of the 60-mm. mortar shell body. As shown in Fig. 140, the shell is held on a threaded arbor fixture equipped with a quick release. This fixture is operated by an air cylinder at the other end of the spindle. Four turret stations are used in this set-up. At the first station the hole *K* is drilled, then this hole is bottom bored, chamfered at *J* and faced at *I* with a multi-blade high-speed steel tool in the second turret station. Then the turret is indexed two stations to bring the recessing tool into position and the recess at *L* is cut with hand feed. Next, a solid ground-thread tap in a friction-type holder cuts the thread at *K* in the small end of the shell body. With a 5-hp. motor, floor-to-floor time is 1.1 min. per shell.

Eleven carbide-tipped tools are used in the set-up shown in Fig. 141 for a Jones & Lamson 8 × 15 in. Fay automatic lathe when turning the 60-mm. mortar shell body. Bodies to go on this set-up are bored, faced and chamfered at each end, but not threaded. The part is held on an air-operated spindle fixture which pilots in the bore of the large end, using air-operated fingers to grip on the inner surfaces for driving. The small end of the shell is supported on a special tailstock center locating on the chamfer of the hole. As some of these shell are made by seam welding two stamped pieces together, it may be necessary to remove flash before the turning operation. In the set-up shown, the spindle is driven at 402 r.p.m. by a 10-hp. motor, giving a cutting speed of 275 ft. per min. Feed of the turning tools is 0.016 in. per rev. Tool 1 rough turns the bourrelet and then turns the ogive on the large end. Tool 2 then finish turns the bourrelet while tool 3 is turning the long taper from the small end. After the front carriage has completed its operation, the back arm is brought forward to chamfer the two ends of the shell body with tools 4 and 11, and to form turn the bourrelet with tools 5 to 10, inclusive. The estimated production, when 25 per cent has been allowed for extras, is 61 pieces per hour. After this operation, it is necessary to deliver the shell body to a threading machine for tapping both ends. Often this is done in a two-spindle threader, using one spindle for the small end and the second spindle for the large end of the shell.

Operations on 81-mm. Shell for Mortars

Forged from WD-X1314 steel by the upsetting or pierce-and-draw methods, bodies for the 81-mm., M43A1, high-explosive shell for smooth-bore mortars have a maximum permitted eccentricity between the cavity and the exterior cylindrical surfaces of 0.04 in. on the rough forging. Design is shown in Fig. 142. When machining these shell bodies, dimension tolerances must be controlled to bring the body within the weight tolerance as shown in Table II. The shell must be centered carefully during the various ma-

Fig. 143—Operations on the 81-mm. mortar shell can be performed either on multiple- or single-spindle machines. This set-up on a Bullard Mult-Au-Matic will machine 78 shell per hour



chining operations, in order to maintain concentricity of the cylindrical surfaces. Following maximum eccentricities of cylindrical surfaces will be accepted: (1) between nose threads, fin seat threads and outside cylindrical surfaces, 0.01 in.; (2) between cavity of shell and outside cylindrical surfaces, 0.015 in. As with the 60-mm. mortar shell, and the 75-, 90-, 105- and 155-mm. high-explosive shell previously described, multiple-spindle machines of both the horizontal and vertical types can be used for a number of operations.

In Fig. 143 are shown operations on this shell as performed in an 8-in. Bullard eight-spindle Type D double-indexing Mult-Au-Matic. The shell first is loaded at station 2 on a power-operated fixture which centers and grips the shell body from the cavity. The shell then is indexed to station 4, where the small end of the forging is drilled, rough turned and chamfered as indicated, the drill being made of high-speed steel, while the turning and chamfering tools have carbide tips. The shell next goes to station 6 where counterboring, facing and finish turning is done at the small end. A high-speed steel cutter is used for the small end bore, while a carbide tool finish turns the bourrelet. Final operation on the small end is done at station 8, where the grooving is done in the small end and on the bourrelet. The two tools working on the small end are of Stellite, while the grooving tool is made of high-speed steel and the chamfering tools for the bourrelet are made of Stellite. After indexing from station 8 to station 2, the shell is unloaded, inverted and placed in a power-operated three-jaw chuck at station 1. Three carbide-tipped tools are used at station 3 for the first operations on the large end of the shell body. Then, the shell is indexed to station 5 where four carbide-tipped tools finish machine the large end. At station 7 a collapsible tap threads the large end.

As with the 60-mm. mortar shell, where single-spindle machines are to be used on the 81-mm. mortar shell shown in Fig. 142, a centering operation is necessary at the start of the machining line. This can be done in the same set-up as shown in Fig. 137, except that a larger fixture will be required on the spindle of the Lipe "Carbo" centering lathe. Centering also can be done on a Seneca Falls 9-in. "Star" lathe as shown in Fig. 144. Here, the bomb is held and driven on a special arbor fitted with a multi-lipped hardened member *A* which contacts the radius in the bottom of the cavity and assures a positive drive once the pressure of the drill point is brought into contact. The open end of the bomb is held central with the sliding, spring-loaded taper bushing *B*. The centering attachment, which replaces the ordinary tailstock, is of the hinged type, permitting fast and easy loading without having to move the attachment. All movements of this attachment are controlled with lever *C*, which locks and unlocks the hinged member, advances the center drill to the proper depth and finally swings the hinged member out of the way for unloading. The centering attachment spindle is equipped with a nut *D* and locknut *E* which act as a depth stop. The headstock spindle is revolved at 750 r.p.m., and a production of 100 bombs per hour is easily maintained.

The Warner & Swasey set-up shown in Fig. 145 for the 81-mm. mortar shell includes a turning operation on the bourrelet with the centering operation on a No. 5 turret lathe. The turned portion on the bourrelet later will be used for chucking in the nose end operation which follows. An air-operated expanding arbor holds the shell for centering and turning. This arbor is designed so that its expanding jaws will contact the inside cavity near the large end, and also locates in the taper portion near the tail end. With this arrangement the jaws have a tendency to draw the forging onto the arbor. After centering, the hexagon turret is indexed for turning the bourrelet. This set-up calls for a carbide-tipped single-point turning tool and an anti-friction receding center support is built into the turning head to hold the work while turning. In this set-up the machine is run at high speed for center drilling and, as the turret is indexed to the turning position and advanced for the cut, the motor speed is cut down to obtain the proper cutting speed for the carbide-tipped tool. Also included is a back indexing attachment which returns the hexagon turret to the starting position without effort on the part of the operator. The centering drill is fed by hand, while the turning tool is fed at 0.012 in. per rev.

After centering, the Seneca Falls Machine Company recommends turning the outside diameter and facing the ends to length on a Model U automatic Lo-swing lathe, using a tooling set-up as shown in Fig. 146. The bomb is held and driven on a three-jaw, air-operated internal driver, the piece being positioned by means of a telescoping locator which contacts the end of the driver and the bottom of the bore. It will be noted that the outside diameter of the shell is turned while being driven from the rough bore of the casting. This assures close concentricity between the rough bore and the finish turned diameters. Thousands of bombs have been turned out by this method in Europe without any scrap on a running balance test. The bourrelet, ogive and boat-tail are turned with a three-tool, templet controlled tool-block on the front carriage. Carbide-tipped tools are used. Facing of the ends and cutting of the grooves are done with the seven carbide-tipped tools mounted

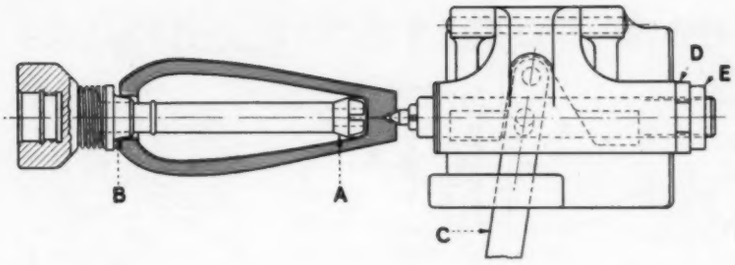


Fig. 144—With a spindle speed of 750 r.p.m., this "Star" lathe will center about 100 mortar bombs per hour. Drive is from the cavity bottom

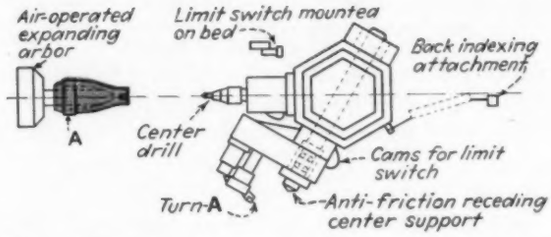


Fig. 145—The bourrelet on the 81-mm. mortar shell is rough turned after center drilling in this Warner & Swasey set-up on a No. 5 turret lathe

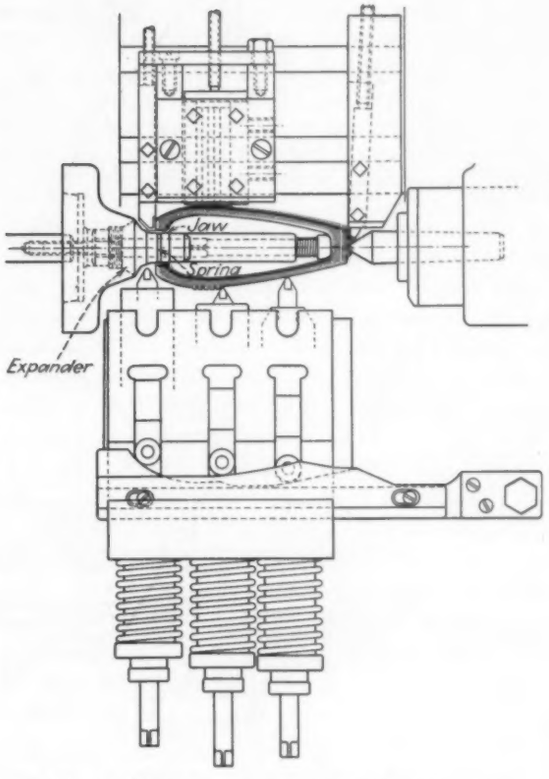


Fig. 146—Ten carbide-tipped tools are used in this set-up for turning 81-mm. trench mortar shell in a Model U Lo-swing lathe

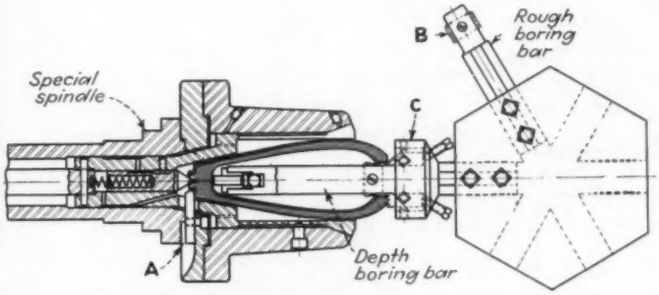
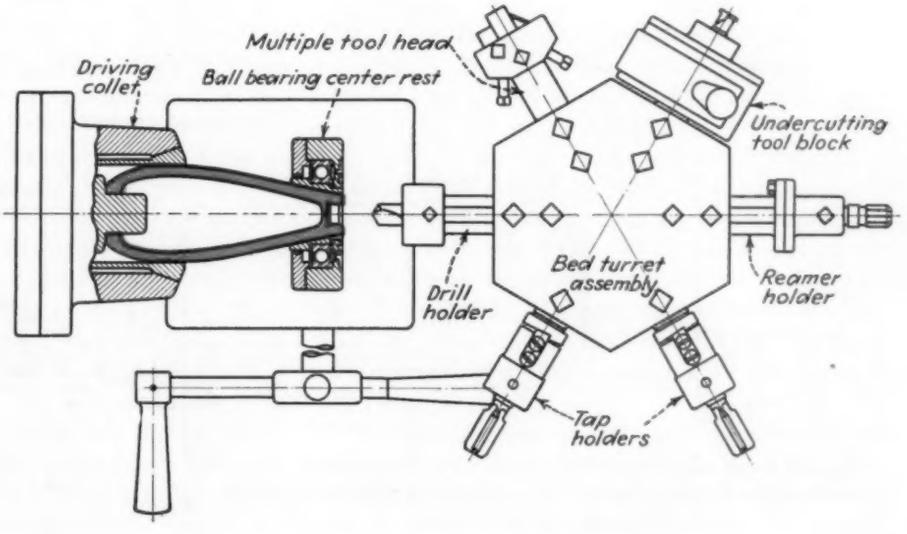


Fig. 147—The large end of the 81-mm. shell can be bored, chamfered and faced to length in this set-up on a "Short Cut" production lathe after the outside has been finish turned

Fig. 148—All operations necessary to finish the small end of the 81-mm. mortar shell are performed with this set-up on a "Short-Cut" lathe



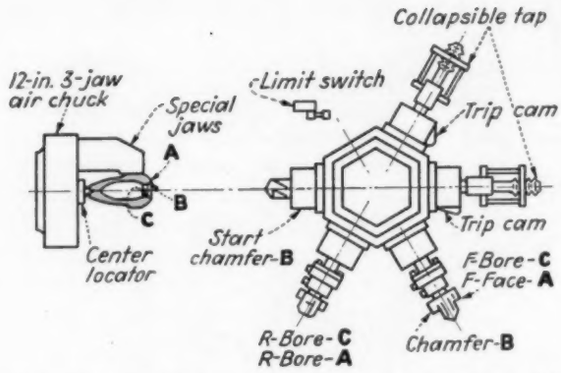


Fig. 149—Operations on the nose end of the 81-mm. mortar shell body in a Warner & Swasey No. 5 turret lathe include rough and finish tapping

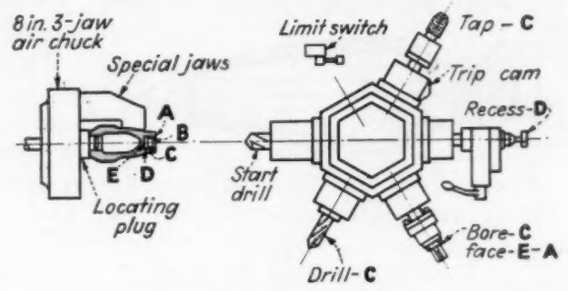


Fig. 150—The small end of the 81-mm. mortar shell can be machined complete in this set-up on a No. 3 W. & S. turret lathe

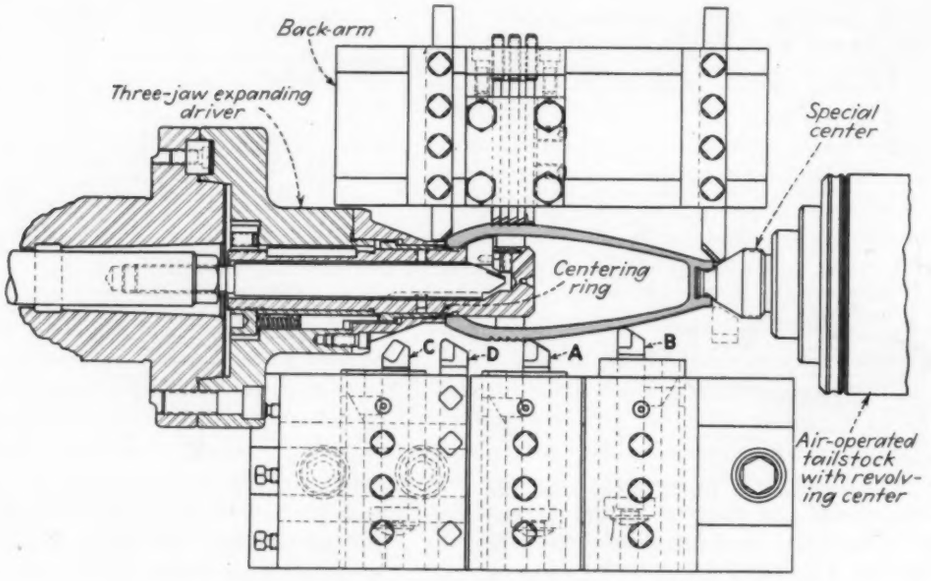


Fig. 151—The 81-mm. M43, mortar shell is turned in this set-up on a Jones & Lamson 12 × 33-in. Fay automatic lathe

Fig. 153—The Lipe set-up on a 15 × 30 in. Carbomatic lathe for turning 81-mm. mortar shell uses carbide-tipped tools cutting at 250 ft. per min.

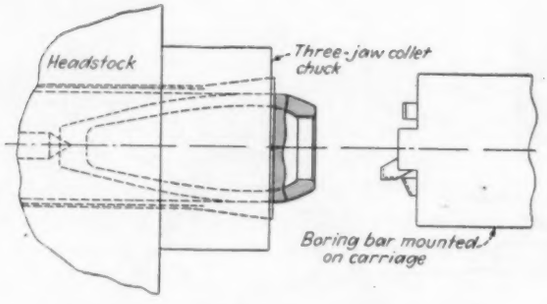
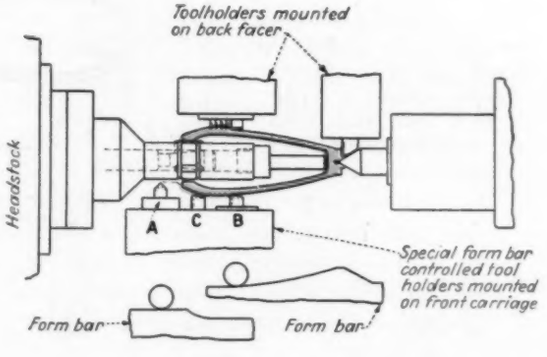


Fig. 152—A single tooling set-up on a Lipe lathe is used for boring, chamfering and facing the large end of 81-mm. mortar shell



on the rear automatic facing slide. All tools operate simultaneously and a production of 50 bombs per hour has been maintained on cast iron shell bodies having a hardness of 220 Brinell.

Fig. 147 shows the tooling for a Seneca Falls "Short-Cut" production lathe for boring the open end of the 81-mm. mortar shell. In this set-up the shell is driven and held in a special expanding collet chuck designed for this operation. The bomb is supported on the small end with a spring-loaded center and block *A* is inserted in the fixed member as an accurate stop for the semi-finished end of the bomb. Boring bar *B* on the carriage turret rough bores, and the combination boring bar *C* finish bores, chamfers, and faces the end to lengths accurately from the bottom of the cavity. This boring bar is fitted with a revolving end stop, as a fixed stop would harm the surface of the cavity. A production of 60 shell per hour can be maintained.

For machining the small end of the 81-mm. shell, a Seneca Falls "Short-Cut" production lathe having a revolving turret can be tooled as shown in Fig. 148. For this operation, the bomb is held in a collet chuck like that used for the machining of the other end. However, as there is considerable overhang from the bourrelet to the end of the bomb, this lathe has been equipped with a special ball bearing rest mounted on a slide operated through the handwheel. The steady-rest slide moves longitudinally in order to facilitate rapid loading and unloading of pieces in the collet chuck. During the machining cycle in this set-up, the drill in the first turret station roughs out the small hole, then the multiple toolhead at station 2 finishes the bottom of the blind hole, chamfers the end of the shell and faces the end to length. The tool at station 3 undercuts at the bottom of the hole. Then the reamer in station 4 finishes the bore to size, and taps in stations 5 and 6 rough and finish thread this end of the shell. Both taps are backed out by reversing the motor driving the spindle. A production of 45 bombs per hour has been maintained.

High-speed steel tools are used for all turret positions in the Warner & Swasey set-up on a No. 5 turret lathe for machining the large nose end of 81-mm. mortar shell bodies, as shown in Fig. 149. This lathe is driven with a two-speed, 7½-hp. motor, so that proper cutting and tapping speeds can be obtained automatically through the tripping of a limit switch with cams on the turret tool heads. The hexagon turret unit on this lathe is equipped with a leading-on attachment for use in conjunction with the tapping operation. With this unit the collapsible taps can be fed into the work at the proper lead, and will enable the operator to produce a better thread consistently. The work is rotated at 124 r.p.m. for chamfering and boring with this layout, chamfering and rough boring being done with a feed of 0.020 in. per rev. and the finish boring at a feed of 0.012 in. per rev.

After the large end of the shell has been machined, it is delivered to a No. 3 Warner & Swasey turret lathe for operations on the small end. This machine also is operated at two spindle speeds with a two-speed, 5-hp. motor, and a double trip cam on the tap holder automatically changes motor speed before and after tapping. In this set-up, shown in Fig. 150, the shell body is held in a three-jaw air-operated chuck with special jaws, and is centered on a locating plug in the chuck. The machining operations on this end of the shell include start drill, drill, counterbore and face the open end, recess the rear portion of the thread, and then tap with a solid ground-thread tap. The work is rotated at 352 r.p.m. for drilling and boring, and at 176 r.p.m. for tapping. A feed of 0.012 in. per rev. is used for the drilling and counterboring operations.

In Fig. 151 is shown the tooling layout for turning the outside surfaces of a 81-mm. high-explosive mortar shell in a 12 × 33-in. Fay automatic lathe following machining of the two ends. In this set-up the shell body is centered and driven from inside the cavity by a three-jaw expanding driver, and is supported on the small end by a special center in an air-operated revolving tailstock. The two ends of the shell are not threaded prior to this operation, but later are delivered to a two-spindle tapper. All tools used in this layout are carbide-tipped, and each is separately adjustable in the various toolholders.

Two carriages are used on the front of the lathe so that tools *A* and *B* can be adjusted radially with relation to tools *C* and *D* in order to control the weight of the bomb. Tools *A*, *B*, and *C* are mounted in standard taper turners controlled by shaped formers, while tool *D* is held in a fixed position for turning the bourrelet. Tools *A* and *B* divide the cut on the long taper, and tool *C* form turns the ogive at the large end. After the bourrelet has been turned by tool *D*, the back arm is brought forward to chamfer both ends of the shell and to form turn the bourrelet. The spindle is rotated at 392 r.p.m., giving a cutting speed of 325 ft. per min. Feed per revolution for the tools on the two front carriages is 0.023 in., and the back arm forms and chamfers during the time required for operation of the front carriages. Estimated production with this set-up is 80 pieces per hour.

Bodies of 81-mm. mortar shell, after having been centered and rough-turned on the bourrelet in a previous operation, are bored at the large end in the set-up shown in Fig. 152 before turning the outside

surfaces in the set-up on a Carbo-matic lathe as in Fig. 153. The layout in Fig. 152 calls for the use of three carbide-tipped tools in a boring bar mounted on the carriage of a Lipe nose boring lathe. For this operation, the lathe is driven at 550 r.p.m. by a 5-hp. motor. Cutting speed is 250 ft. per min., and the tools are fed by hand against a positive stop. Estimated production is 50 pieces per hour.

Following the operation shown in Fig. 152, the shell bodies are delivered to a Lipe 15 × 30 in. Carbo-matic lathe which uses a tooling layout as shown in Fig. 153 for turning the outside surfaces with carbide-tipped tools. In this set-up, three carbide-tipped tools are mounted on the front carriage for turning the outside surfaces of the shell bodies, tools *A* and *B* being mounted in taper turning slides for turning the small end and the ogive. Tool *C* is mounted in a fixed position on the front carriage and is used only for turning the bourrelet. While the front carriage tools are turning the shell body, the back facer is fed forward to face the small end of the shell and form turn the bourrelet. Carbide-tipped tools also are used in the tool holders on the back facer. With the lathe spindle driven at 312 r.p.m. by a 15-hp. motor to give a cutting speed of 250 ft. per min., and using a 0.020 ft. per rev. feed, production per hour is estimated at 50 pieces.

Bourrelet Sometimes Finished Separately

In some instances, contractors for shell have found it desirable to finish the bourrelet separately in order to insure production of the fine finish desired. Sometimes this final machining operation is done in a turning lathe, using a fine feed, and in other instances it is done with a cylindrical or centerless grinder. Since the bourrelet and the brass band are the only surfaces on the shell which contact the gun barrel when the shell is fired, it is essential that the bourrelet have a smooth surface to avoid damaging the rifling in the gun.

The set-up shown in Fig. 154 has been developed for finish turning the bourrelet of a 155-mm. shell on a Seneca Falls Model U automatic Lo-swing lathe. The method of holding and driving this shell assures concentricity between the finish turned bourrelet and the diameters finished in previous operations. The tailstock is air-operated, and the pressure is great enough to force the finish turned boat-tail taper into the large female center which drives the shell. A carbide-tipped single-point tool on the front carriage is fed longitudinally for 1.5 in. with a 0.010 in. per rev. feed and a light cut to finish the bourrelet. With a spindle speed of 222 r.p.m., giving a cutting speed of 350 ft. per min., production per hour at 85 per cent efficiency is 39 pieces. When the cut is finished the shell is released from the driver by pressure from a pushbar actuated by an air cylinder on the lathe spindle.

When the bourrelet is to be finished ground after the shell has been machined all over, a set-up like that shown in Fig. 155 permits rapid handling in a cylindrical grinder. Developed for use on a Landis Type C 10 × 36 in. plain hydraulic grinder, this arrangement calls for the use of a centering plug in the threaded nose of the shell. Plug is inserted and tightened in one shell while another is being ground. The grinder has a live spindle headstock with a cathead mounted driving head. The footstock is hydraulically operated and has a live work center. The shell is laid on a work cradle located on the work table between the headstock and the footstock. Then the footstock spindle is advanced, pushing the shell into the tapered driving head. When grinding has been completed an hydraulically operated ejecting finger in the headstock pushes the shell back onto the work cradle. The machine has an hydraulic straight infeed mechanism and a reciprocating wheel spindle mechanism. Removing 0.030 to 0.035 in. stock and grinding within a limit of 0.005 in. on the diameter, estimated production based on a 1-hr. run at 100 per cent efficiency is 70 to 75 shell per hour.

The Cincinnati centerless grinder has been used in a number of instances for grinding various surfaces on shell in the 75-to 155-mm. size range. Design of European and American shell in this range varies considerably; some are smooth and short, and require a ground finish on all outside surfaces except the band groove, while others are longer and have the major portion of the body slightly smaller than the bourrelet. In the latter types, it is seldom that any surface except a bourrelet is ground. Where the shell is light enough for easy handling, it usually is fed into the grinder with a hand pusher arrangement. The 105- and 155-mm., on the other hand, are somewhat heavier, and should be delivered to the machine by roller conveyor, as shown in Fig. 156. Where this is done, the work rest often is equipped with a set of rollers that can be elevated to bring the work into grinding position. Shell having front and rear bourrelets are better suited to grinding in centerless machines than are those which have only one bourrelet. The machine shown in Fig. 156 uses three grinding wheels and three regulating wheels.

Cover Disks Welded to Base

Should there be a pipe or other defect in the shell base there is danger both of contamination of the high-explosive charge in the shell cavity, and of flame from the propulsion charge detonating the explosive charge while the shell still is in the gun. In order to

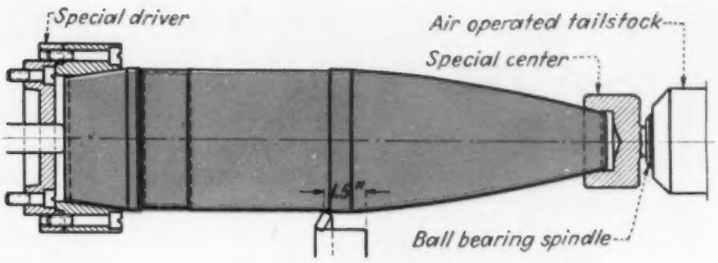


Fig. 154—Sometimes the bourrelet is finish turned in a separate operation. This set-up is for a Model U automatic Lo-swing lathe

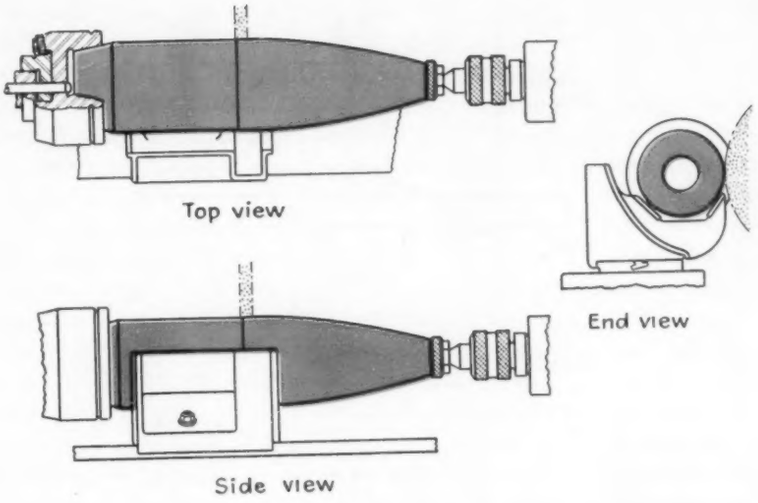


Fig. 155—When the bourrelet is to be ground, a set-up like this on a cylindrical grinder insures accuracy of finish

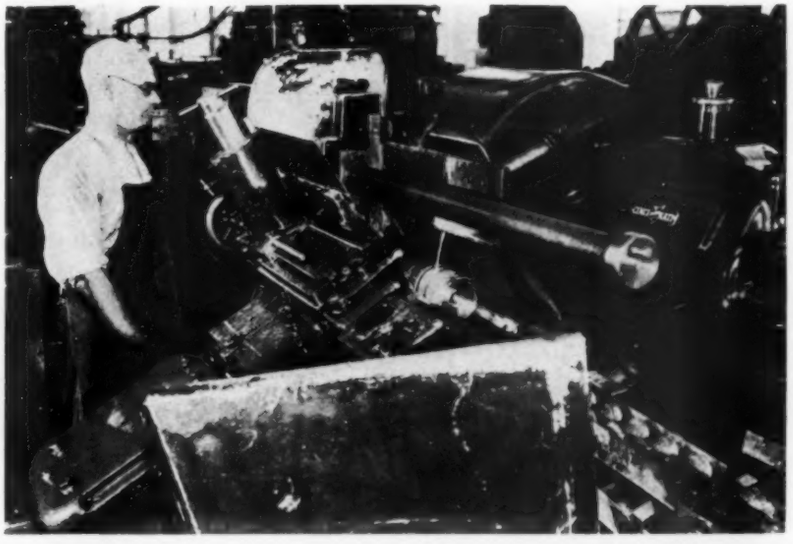


Fig. 156—Centerless grinders have found wide use in Europe for grinding various types of shell, and have been used in the United States for those shell which require a ground bourrelet

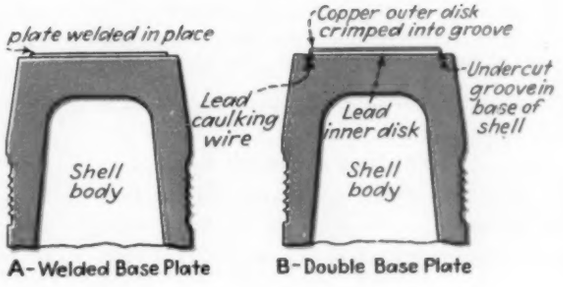


Fig. 157—Two designs of base covers now are used on U. S. Army shell in the 75- to 155-mm. size range. The welded type shown at A is the one generally employed. Seal must be gas tight

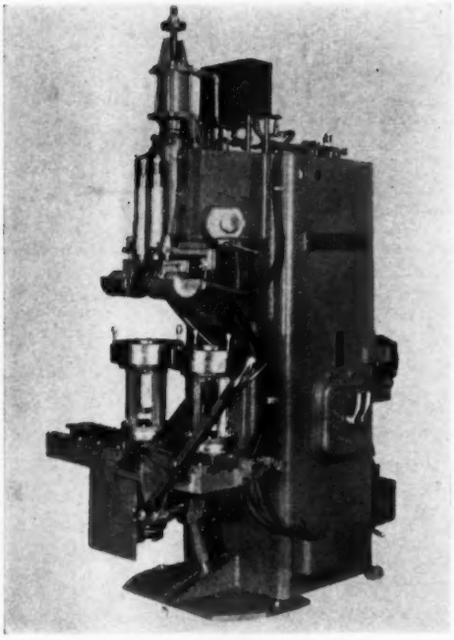


Fig. 158—The Thomson-Gibb double-roll seam welder for attaching cover disks to the base of shell has two pot fixtures to speed production

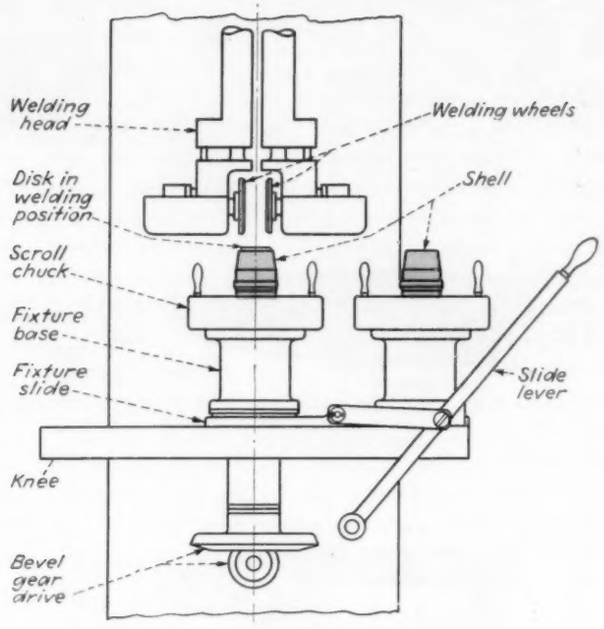


Fig. 159—Operator loads a shell in one fixture while the Thomson-Gibb welder automatically seam welds the cover disk to the base of another shell

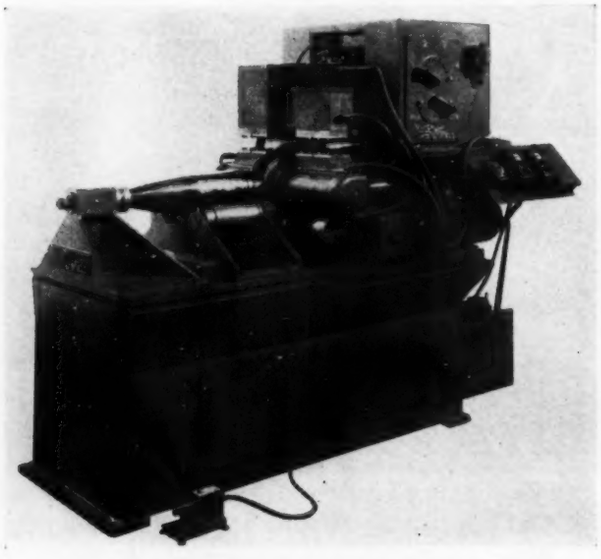


Fig. 161—This special Taylor-Winfield double-roll seam welder supports the shell horizontally

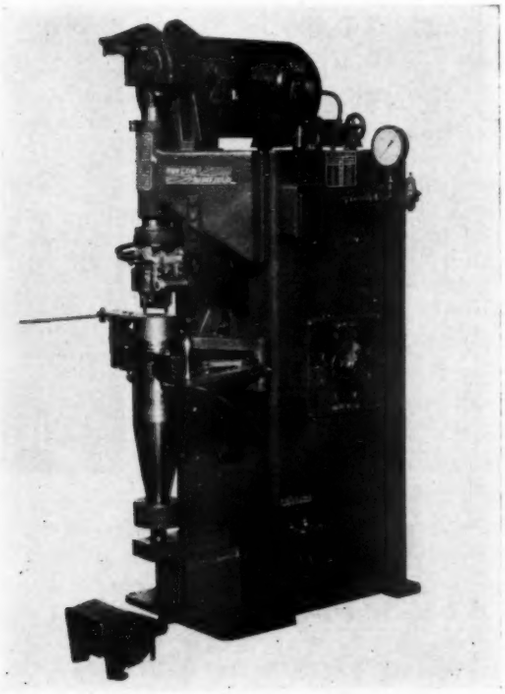


Fig. 160—Shell is held stationary and the twin-point head rotates on this Taylor-Winfield press-type welder for attaching cover disks to 155-mm. shell. Overlapped spot welds withstand hydraulic pressure of 1,700 lb.

prevent such possible disaster, several means have been used. During the last war most high-explosive shell had a bored and threaded recess in the center of the base on the outside to receive a base-plate forged from flat steel. The grain of the metal in the base-plate ran at right angles to the axis of the shell, and the plate was accurately machined to fit the threaded hole. After assembly of the base-plate in the end of the shell, it was riveted in place and finally turned flush with the base of the shell.

Today, German, French, Greek and Italian shell do not have base plates, but they still are used on English and American shell. In the English design the base plate is cupped slightly from sheet steel and is flattened and peened into an undercut counterbore in the base of the shell. There are two designs of base plates used on American shell in the 75- to 155-mm. range. These are shown in Fig. 157. At *A* is shown the welded base cover plate which is a steel disk blanked from 0.031 in. (No. 22 U.S. gage) thick WD-1010, WD-1015 or WD-1020 bright, soft-annealed steel. These plates are secured to the base of 75-, 90-, 105- and 155-mm. shell, as well as the 3-in. anti-aircraft shell, with overlapping spot welds or seam welding around the edge. The base cover disk must be concentric with the base of the shell within 0.03 in. As an alternative to the welded steel cover disk on the 3-in. anti-aircraft shell, a 2.50 —0.02 in. diameter half-hard brass disk 0.032 in. (No. 20 B & S gage) thick sometimes is sweated to the base of the shell with solder.

At *B* in Fig. 157 is shown an alternate design for the cover plate used on 155-mm., M-101 and M-102, high-explosive shell. Here, a lead inner disk is held in place with an outer disk of copper, the outer edges of the copper disk being crimped into a groove cut into the base of the shell. A lead caulking wire is forced into this groove to hold the copper disk in place. The welded steel cover disk is the design most generally used.

In Fig. 158 is shown a Series 176 seam welder developed by Thomson-Gibb especially for welding base-cover disks on shell. It is powered by a 40-kva. water-tube type transformer with 16 points of heat regulation, and is mechanically driven by a ½-hp., 1,200 r.p.m. motor. The welding wheels are 4 in. diameter, each wheel bearing being carried in a long vertical slide backed-up by an adjustable pressure spring. The welding wheels are adjustable horizontally to take care of the variation in disk diameter from the 2.26-in. disk used on the 75-mm. shell to the 4.50-in. disk for the 155-mm. shell. Each wheel is connected to one snout of the transformer to pass the current from one wheel through the disk and shell to the other wheel. A two station fixture is mounted on the fabricated steel lower knee of this welder, as shown in Fig. 159. Each fixture has a quick acting, hand-operated three-jaw chuck which grips the shell on the body diameter and centers the nose end by a spring-backed cup in the bottom of the chuck. A hand lever shifts the fixture slide back and forth and a latch is provided to locate either fixture centrally under the welding wheels. Each fixture is arranged to rotate when in the welding position, and is driven through gearing and a one-revolution clutch and worm gear combination. A variable speed drive provides infinite variation of speed from 2 to 6 ft. per min. at the welding wheels. After the shell has been loaded in its fixture and positioned under the welding wheels, the operator places the disk in welding position and operates a pushbutton to bring the wheels down, and immediately pushes a second button to start the shell rotating. This automatically starts the welding current. After the shell has rotated 180 deg. the current is cut off and the wheels raised automatically. In the meantime, the operator has unloaded and loaded the fixture in the outside position, and after the fixture in the welding position has come to a standstill, he shifts the slide and brings the second station into welding position. The cycle then is repeated. A limit switch actuated by the horizontal slide prevents starting the machine unless the slide is indexed correctly. Based on an average welding speed of 5½ to 6 ft. per min., which has been found most favorable, estimated production with one operator at 80 per cent efficiency is 240 shell per hour of the 75-mm. size. With two operators, this production can be increased to 320 shell per hour of the same size.

In Fig. 160 is shown a special rotating twin-point Type EN press welder built by the Taylor-Winfield Corporation for attaching the base cover plate on 155-mm. shell. This type also has been built for smaller shell. In this machine the shell is held stationary in a clamping device and the upper head operates at about 150 strokes per minute to produce overlapping spot welds. An indexing device is built into the head to turn the points approximately ⅛ in. for each weld. Each one-half revolution of the head produces a welded shell. Tests have shown these welds to be satisfactory up to a hydraulic pressure of 1,700 lb., at which point the plate bursts. A somewhat different welder for attaching base cover disks to 155-mm. shell is shown in Fig. 161. This is a horizontal double roll seam welding machine in which the shell is supported by ball-bearing rollers in front of the welding wheels.

After all machining operations have been completed, and the shell has been cleaned by washing or degreasing, it is sent to a final inspection station for

a thorough check before it is turned over to the ordnance department inspector for final approval. This final production inspection includes weighing the shell, and stenciling the weight zone on the nose if called for in the specifications, as well as a 100 per cent check of a number of the shell's dimensions. Ordinarily, very little trouble is encountered in holding the weight limits on the 75-mm. shell and, because of this, it is not necessary to inspect them for weight before they reach the final inspector. Occasionally, where a machine set-up has been changed, a foreman may check the weight of a shell just to make sure that everything is satisfactory before letting the machine start on its regular production, but usually only a small percentage of these shell are weighed before final inspection. On larger shell it frequently is necessary to weigh the shell when the base-end operations are performed, so that overweight shell may be brought within specified limits before the band is applied. A direct-reading scale of one of several types should be used, so that the weight can be checked instantly without the operator having to adjust weights on the scale.

Ordinarily, the production inspection operation on finished shell consists of checking and cleaning out threads, checking the cavity for dirt or scale, and wire brushing if necessary, and also checking the bourrelet diameter and the concentricity of the outside surfaces with the cavity. This inspection simplifies government inspection, keeps the production line under control, and reduces materially rejections by the government inspector. Several ingenious electrically controlled inspection machines have been developed for checking quickly the various outside diameters of finished shell. Two of these are shown in Figs. 162 and 163. In the Pratt & Whitney Electrolimit gage shown in Fig. 162, the shell is stood on its base and pushed carefully into a series of calipers arranged in a vertical series to measure each diameter to be inspected. Each caliper is connected to an electric light, so that if any diameter to be checked is either oversize or undersize, the light flashes on to indicate the error. These lights are mounted behind small windows in a vertical screen placed directly in front of the operator. Each window is connected to its respective diameter on a large-scale shell outline by a heavy black line. With this machine, shell can be inspected for diameters at the rate of about one every three seconds.

The Multicheck Electrigage developed by Sheffield Gage Corporation and shown in Fig. 163 also is adaptable for the inspection of fuze elements, cartridge cases and other munitions items. Measurements of lengths, diameter and depth are flashed simultaneously on a control board by colored signal lights as the part being inspected is placed in the gaging position. An individual gaging head is used for each dimension to be checked, and each head controls a separate signal light. When one of these signal lights shows amber in the gaging operation, the diameter is within tolerance. When the light shows red, it indicates that the diameter is undersize, and when green the diameter is oversize. In addition to the individual lights, this gage has a master signal light which integrates all measurements. When the master signal shows white, all dimensions are within tolerance. When it is red, the individual signal lights are observed to determine which dimension is incorrect, and whether it is plus or minus. It is claimed that one operator can check seven dimensions on a 75-mm. shell at the rate of 600 per hour.

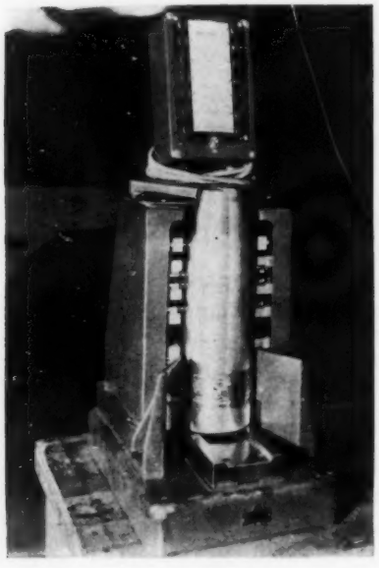


Fig. 162—This Electrolimit gage was made up by Pratt & Whitney especially for checking the various diameters of finish-machined shell. Lights flash on when any size being checked is over or under the established limits

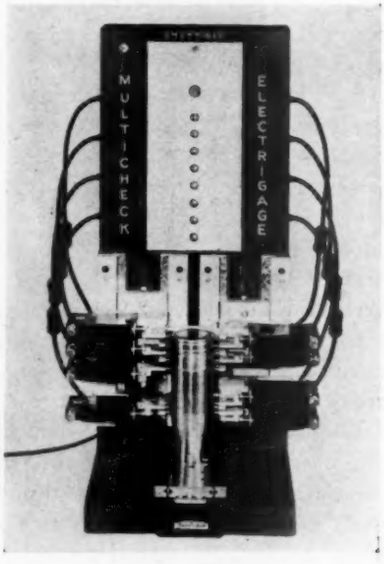
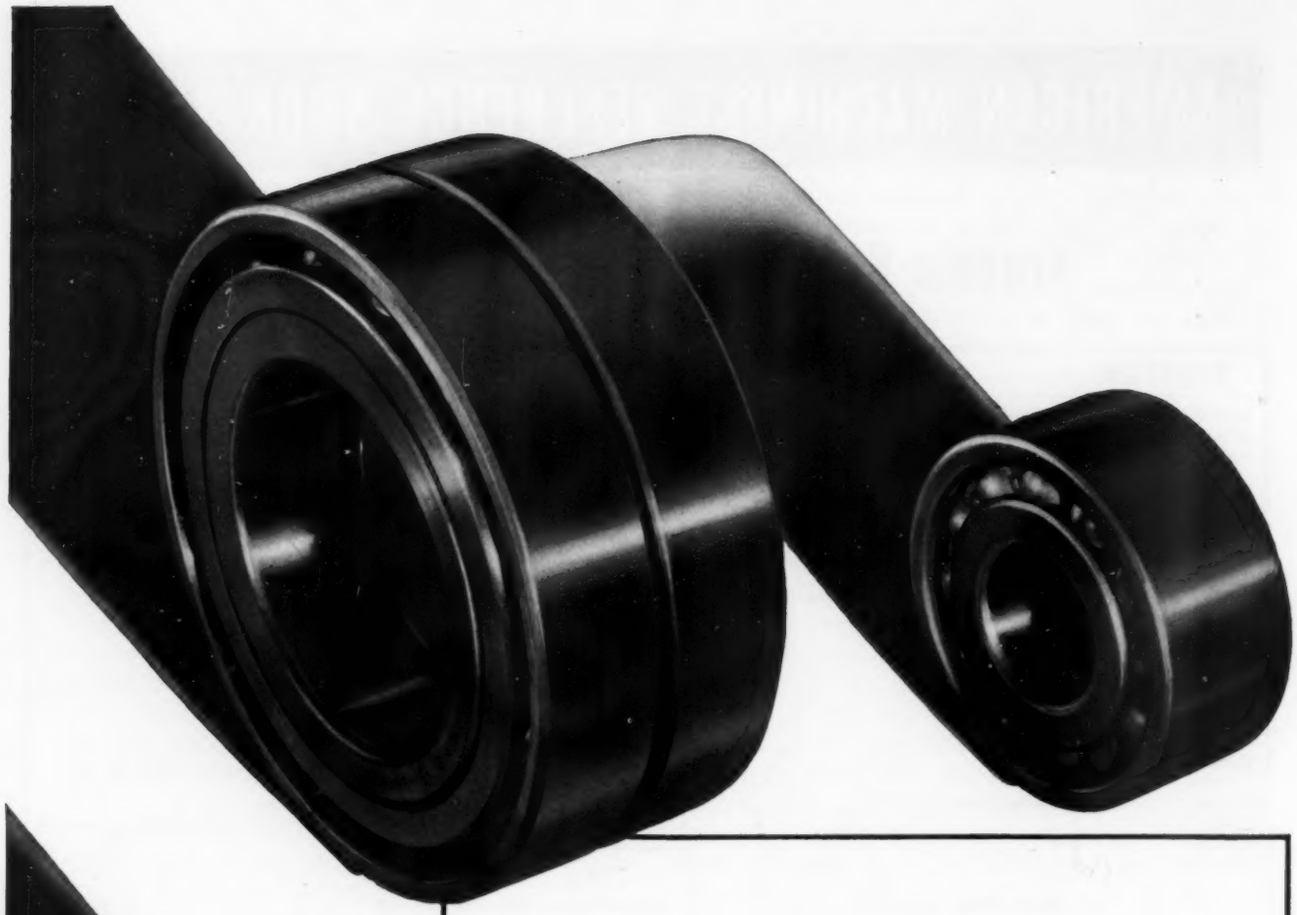


Fig. 163—Sheffield's "Multicheck Electrigage" for checking all shell diameters at once uses a system of amber, red and green lights to show whether each dimension is correct, or over or under size

AMERICAN MACHINIST REFERENCE BOOK SHEET

Trouble Correction For D. C. Motors—I

SYMPTOM	CAUSE	REMEDY
Motor will not start	Switch open	Close switch
	Fuse blown	Replace fuses
	Wire broken	Repair
	Bearing frozen	Replace bearing and clean shaft
	Overload	Reduce load or use larger motor
	Excessive friction	Reduce load or belt tension Add or renew oil Shift bearings until armature turns freely by hand Straighten bent or sprung shaft
Motor starts and then stops	Power failure	Check load and reduce if necessary Check fuses and overload relay Check control contacts
Motor starts in opposite direction	Power lines reversed	Reverse armature connections Check if last connections were inadvertently reversed at switch board or elsewhere
	Shunt field connections reversed	Reverse shunt field connections
Motor runs too slow	Overload Short circuit in armature	Remove excess load Look for metallic contact between commutator bars and remove Test for internal short and repair armature
	Friction	Reduce belt tension. Align bearings
	Low line voltage	Raise voltage
Motor runs too fast	Poor field connection	Make clean and tight connections
	Too high resistance in field circuit	Decrease resistance
	Brushes off neutral	Set brushes correctly
Motor draws excess current at normal speed	Overload	Reduce load
	Brushes off neutral	Reset brushes
	Bearings tight	Remove and scrape bearings
	Short circuit in armature	Remove metallic contact between commutator bars Test for internal short and repair armature
Sparking at brushes	Commutator rough	True up commutator
	High mica on commutator	Undercut mica
	Brushes too short	Replace brushes
	Brushes off neutral	Reset brushes
	Short circuited armature coil	Remove metallic contact between commutator bars Test for internal short and repair armature
	Open circuit in armature	Test and repair
	High bar on commutator	Let down with mallet and tighten clamping ring or grind or turn down to level of other bars
	Low bar on commutator	Grind or turn down commutator till flat disappears
	Interpole winding shorted	Measure resistance of each coil and replace coil having lowest resistance



Bearing the Burden

of

Production under Pressure

— with the Endurance

of Forged Steel

NEW DEPARTURE

THE FORGED STEEL BEARING

New Departure - - Division of General Motors - - Bristol, Connecticut

AMERICAN MACHINIST REFERENCE BOOK SHEET

Trouble Correction For D. C. Motors—II

SYMPTOM	CAUSE	REMEDY
Motor vibrates	Unbalanced armature	Balance armature
	Unbalanced pulley	Balance or replace pulley
Brushes wear rapidly	Rough commutator	Smooth commutator
	Brushes too soft	Use correct grade
Commutator hot	Wrong grade of brushes	Replace with correct grade
	Excess brush spring tension	Decrease spring pressure
	Brushes off neutral	Reset brushes
Armature overheats	Overload	Remove excess load
	Short circuit in armature	Look for metallic contact between commutator bars, and remove Test for internal short and repair armature
	Broken circuit	Test and repair
Field coils overheat, one coil cold	Cold coil is short circuited, overheating other coils	Install new coil
Bearings hot (S — Sleeve) (B — Ball)	(S & B) Bent or sprung shaft	Straighten or turn in lathe
	(S & B) Poor alignment	Realign
	(S & B) End Thrust	Reduce thrust from driven equipment or supply external equipment to take care of thrust
	(S & B) Too much belt tension	Loosen belt and reduce load if necessary
	(S & B) Lack of lubrication	Replenish oil or grease
	(S) Oil rings not turning	Reseat or renew oil rings
	(S) Oil too thick in cold weather	Replace with low cold test oil
	(S) Oil too thin	Use heavier oil
	(S) Bearings worn	Replace bearings
	(B) Broken ball	Replace bearing
	(B) Too much grease	Check and remove excess grease
Noise	Armature rubs pole piece	Replace worn bearings. Tighten pole piece. File pole face where armature strikes
	Loose on slide rails	Line up motor and tighten bolt
	Loose screws, bolts or connections	Tighten
	Singing or hissing of brushes	Adjust brushes in holders Apply, *with caution* a little mineral oil or vaseline to commutator and then *wipe off*
	Humming as armature lugs or teeth pass pole pieces	Slope ends of pole pieces so that armature teeth pass edges at an angle
	Slipping of belt from overload	Tighten belt or reduce load
	Clapping or pounding of belt	Use endless belt. If laced belt must be used, have square joints properly laced

Courtesy General Electric Company

G.T.D. TAPS SET FINE RECORD

THE job is tapping a deep hole in a brass body — thread size ¼"-24. "GREENFIELD" High Speed Ground Thread Taps, especially designed for brass, were selected for the job and completely satisfy the manufacturer. The result proves the importance of calling in experienced threading engineers in order to obtain tools that will give lowest cost per tapped hole.

LEADERSHIP
GTD
GAGING
THREADING
DRILLING

Today it is hard to get small tools as fast and in as great quantity as most manufacturers wish them. So it's more important than ever to get the greatest possible production from every single tool. It's a pretty good time to draw on "GREENFIELD'S" huge fund of experience.

GREENFIELD TAP & DIE CORPORATION

GREENFIELD, MASSACHUSETTS

DETROIT PLANT: 2102 West Fort St.
WAREHOUSES in New York, Chicago, Los Angeles
In Canada: GREENFIELD TAP & DIE CORP. OF CANADA, LTD., GALT, ONT.

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TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

WHAT ABOUT STRIKES?

DEFENSE OFFICIALS have ordered the Allis-Chalmers strikers to resume work because the Navy's shipbuilding program is imperiled. Yet strikes and threatened strikes connected with defense industries grow in numbers.

An alarmed public rightly asks, "What can be done to insure industrial peace? Are union leaders responsible officials, or are they using the rank and file members as pawns in a game of personal aggrandisement?"

Even labor's staunchest friends, like President Roosevelt and Senator Norris and Mayor LaGuardia, appear to be weary of the strife which both the C. I. O. and A. F. of L. have stirred up, and to be fearful that our armament program and aid to Britain will be gravely delayed.

Two ways seem to be open to exert effective control over the situation. One is through a board similar to the War Labor Board of 1918.

In the first World War over 3,000 strikes occurred and more than 6,000,000 man-hours of labor were lost in the first six months.

The result was appointment of the War Labor Board, which was the highest authority in labor disputes. Its decisions were defied only twice. Once the management of a company said that it would not abide by the board's judgment, whereupon the government promptly commandeered the plant. On another occasion a group of munitions workers in Bridgeport, Conn., refused to call off a strike upon the board's order. President Wilson instructed the local draft boards that the strikers were no longer to be granted exemption from military service because they were essential in industry, nor were they to be given jobs in other munitions factories. The result was that the strikers returned to work within a few days.

The National Defense Mediation Board, recently appointed by the President, may have the makings of another War Labor Board. But it is our opinion that it must have more authority than it now possesses to be effective in stopping strikes. In any event, either the new board or still another board yet to be created must be given powers adequate to prevent so many work stoppages.

Another potent method of achieving labor peace is by means of a completely democratic process—insisting upon a vote of all employees of a plant before a strike is authorized. The vote would be by secret ballot supervised by impartial outside people. If a majority did not approve a walkout, a strike would be avoided.

So much has been said and written about strikes being precipitated by a small minority of radical union employees that such a procedure would be a true test of whether actual sentiment for a strike was strong or weak. Why not find out accurately and without prejudice?

This is no theoretical proposal. It has already been written into several union contracts in the automotive industry. Thus far it is working out as a stabilizing factor against sudden and irresponsible work stoppages.

The time is at hand when the patriotism of both management and labor are to be put to the test. Management must exert every effort to see that employees get the highest posssible wages, the best possible working conditions and the fairest kind of treatment. Union leaders must demonstrate that they can control their members, that they are capable of keeping agreements, and that above everything else they want to see Uncle Sam through this crisis.

Both sides are on trial and neither can afford to take a "public-be-damned" attitude. For upon the head of anyone who dares in this emergency to pursue such a policy will descend the wrath of the American people. His cause will be irreparably damaged for years to come.

Burnham Finney

GAGING BUSINESS

February shipments of machine tools from 95 per cent of the industry totals $52,100,000. Insufficient labor supplies may hold Maritime Commission's program to the 200 ship schedule

Plant expansions and priority controls are making themselves felt in the race for increased armament output. The metal-working industry is still struggling under a heavy load of orders, with more in sight as the impetus of the Lend-Lease Act reaches full force, but production is progressing on a more orderly footing.

Machine Tools—February shipments of machine tool builders, comprising over 95 per cent of the industry, totaled $52,100,000. Expectation is for $60,000,000 monthly output by June 1. The Lend-Lease Act will mean at least $400,000,000 in new orders. For some classes of equipment an improvement in deliveries is noted for which credit goes to the effectiveness of priority control; new plant capacity is also helpful. Machine tool builders still have a heavy backlog of orders and are constantly training men and increasing output to meet the demands of new defense projects. Typical of the condition of the industry, one manufacturer reports that although March orders will exceed shipments by about 80 per cent, additional equipment and newly trained men will swing the balance by July 1. Some criticism has been voiced at the Navy Department's modification of the "escalator clause" in its contracts which manufacturers feel may deny them needed protection on long-term contracts.

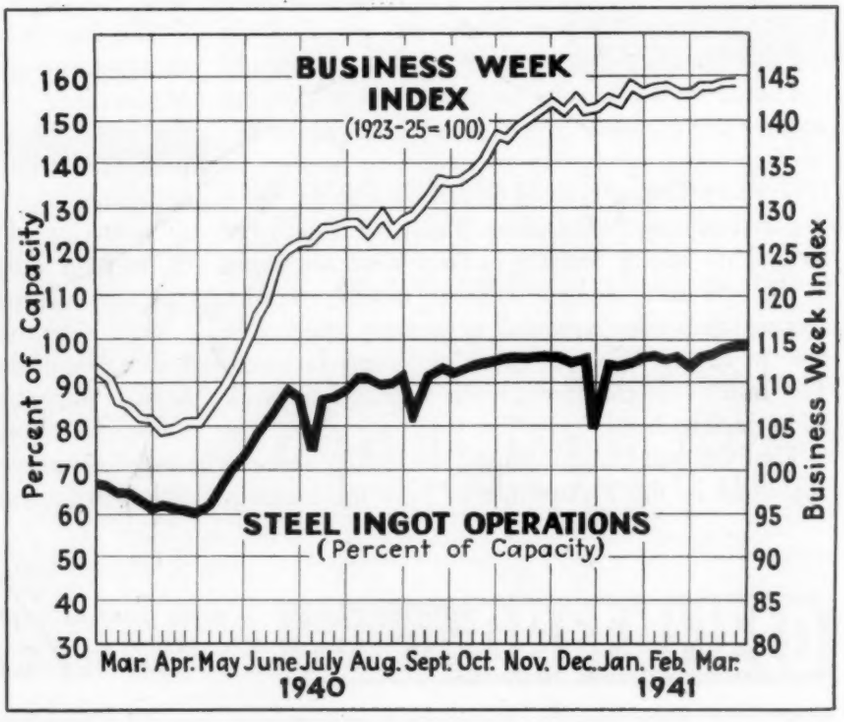
Ship Building—There is strong opposition in the Maritime Commission to taking on more than the planned 200 cargo ships on the ground that sufficient labor is not available. It is pointed out that some shipyards would have to compete with the yards already engaged on naval ships. Despite this opposition the prospects are for a vast amount of additional merchant shipbuilding. Figures as high as 600 ships are being discussed. The first of seven contracts for the 200 cargo ships went to the North Carolina Shipbuilding Co. for 25 ships on a cost-plus-fixed-fee basis. Estimated base cost $337,500,000.

Steel—Operating rate of the steel industry still crowds 100 per cent. Two Navy contracts have been awarded Carnegie-Illinois totaling $3,307,000. The first provides installation of equipment at Carnegies Munhall, Pa., plant for production and treatment or armor plate. The second provides like facilities at the Mingo Junction, Ohio, plant. Republic Steel announces the largest backlog of its history despite major expansions of three 50-ton electric furnaces to be augmented shortly by two similar units and increased open hearth capacity.

Railroad Equipment—Illinois Central is asking bids on 2,400 freight cars. The recent order for 1,000 all steel hopper cars placed by Chesapeake & Ohio was divided between American Car & Foundry, Pullman-Standard and General American Transportation; total value $2,285,000. Southern Pacific alloted 2,500 freight cars to Pressed Steel Car, General American, Pullman and Bethlehem Steel. Chicago, Milwaukee, St. Paul and Pacific is financing new equipment including 16 diesel locomotives, 525 freight cars and 20 passenger cars. Continuation of such buying should boost the 1941 total well beyond the $252,000,000 placed last year for railway equipment.

Farm Equipment—The Harvester-McCormick plant reopened a week ago Monday despite adverse C.I.O. pressure. The probability is that an election will be held to determine the authorized bargaining group; a former independent union was dissolved while the A. F. of L. has come into the picture with a new vertical union for farm equipment workers. Deere & Co. has formed the Iowa Transmission Co. to assemble about 1,500 transmissions for medium tanks. About half the contract for $11,000,000 will be sub-contracted to shops outside the Deere plant at Waterloo. Much of the subcontracting will be for needed armor plate castings. Deliveries to farm equipment dealers are slow.

Munitions—Nine companies engaged in aluminum ware manufacture met with defense officials in Chicago to discuss the possibilities of converting their facilities going out of service because of the aluminum shortage to defense work. Recognition of the need to keep non-defense plants supplied at least partially with raw materials is indicated in the OPM statement on aluminum. One per cent of the available supply will be parcelled out to such companies. The $750,000,000 for plant expansion in the Lend-Lease Act is only a starter. The approved budget for additional funds for the Army totals nearly $6,000,000,000 although how much will be for plant expansion is not yet determined. More money for the Navy has also been approved including large funds for plant expansion. Construction and operation will be by private management. Neither labor nor management will get any favors from Washington that may slow down the armament program. Tightening of the position against radical labor moves may seem slow, but the trend is evident. Production on defense contracts is being stepped up and delivery dates are being advanced considerably.



RECENT CONTRACT AWARDS

WASHINGTON — Among contracbts awarded by the government last week are: Machinery and equipment for expansion—Dow Chemical Co., Freeport, Texas, $8,007,407 — and Wyman-Gordon Co., Harvey, Ill., $1,133,495; cartridge containers—Norris Stamping & Mfg. Co., Los Angeles, $1,336,580; generator assemblies—Leece-Neville Co., Cleveland, $1,595,428; and propeller assemblies — Curtiss-Wright Corp., Caldwell, N. J., $376,395. Bendix Aviation Corp. received orders totaling $3,538,847 for starter, generator, and wheel assemblies.

Discuss U. S. Plans to Speed Labor Training

WASHINGTON—Because the labor skill shortage will become really serious in the next few months, the Labor Department and OPM jointly called to a meeting in Washington recently the representatives of the nation's leading metal-working firms to hear Government plans for speeding its "up-grading" or on-the-job training program.

A findings committee summarized the concensus of the meeting as: (1) defense labor training must be conducted largely within the plants involved; (2) full cooperation of labor, management, and government is essential; (3) apprenticeship training be extended without curtailment of training period; (4) upgrading be expanded, and that standards of promotion are essential; (5) one individual in each plant be responsible for up-grading; (6) experienced prime contractors assist smaller plants and subcontractors in organizing training systems; (7) primary contractor assistance to others should be implemented through the medium of the district office of the Training Within Industry Section of OPM.

LABOR DISPUTES INCREASE

WASHINGTON—Four defense strikes have been sent for review to the Labor Mediation Board. These include disputes at Harvester, Vanadium, Cyclops Steel, and Condenser Corp. Meanwhile in the House last week there was talk of invoking the death penalty for foes of the nation in "factories and elsewhere." In New York state a law has been enacted which will enable special boards to investigate labor disputes where mediation has failed. Following a Knudsen and Knox demand Allis-Chalmers opened its plant in spite of union protests; Wisconsin's labor board maintained that a new vote must be held. U. S. War Department estimates that since January 1 strikes over the nation have caused a loss of one million man-days.

Blanket Priority Rating Applied to Items Needed in Plants of Machine Tool Builders

WASHINGTON—The blanket priority rating, issued last year and which granted machine tool builders an A-1-A preference on orders for items needed in the expansion of their plants, has expired and been replaced with a new blanket rating which applies to all requirements machine tool builders may have. The blanket rating applies to orders for C-machine tools, cranes and hoists, motors, alloy steels in bars, forgings, castings and tubes, iron, steel and aluminum castings, cutting tools and abrasives, instruments and gages, brass, copper and steel tubing and fittings and oil-resisting hose.

A slightly different priority rating has been granted to nine manufacturers of cranes. A rating of A-1-C has been assigned to all their orders for certain types of materials, including those needed for cranes. The new rating is limited to orders for electric motors, switches, controllers, and connections, and for fabricates parts and accessories, steel bars, plates, shapes, forgings and castings.

As regards distribution of machine tools, the directive that deliveries be made only on orders with priority ratings has been somewhat simplified by a rephrasing which permits assignment of an A-10 rating to defense orders which do not now have a rating.

Meanwhile, another study is underway regarding the general direction which went out last month indicating that machine tool makers deliver only on priority orders. On an individual basis, each type of tool, big boring mill or little hand drill, is being studied to determine whether the order is appropriate for that particular case.

Pending completion of this study, some of the rough spots in the broad general order are being smoothed down by a series of supplementary orders. The few firms whose capacities are not entirely taken up with defense orders have been notified that it is okay to go ahead on civilian work provided it is kept at the bottom of the list. A letter has gone out to most of the makers of small portable tools indicating that for the present they may disregard the general order. This letter went to makers of items included on the Priorities Division's list of items marginal to the machine tool industry. There is no clear formula that determines whether an item is on this list or on the machine tool list.

On the used tool front, the reports required from dealers have been modified so as to make them constitute, in effect, a catalog of all used tool available from dealers anywhere in the country, thus simplifying the problems of would be buyers. By present plans dealers report to OPM each tool with description and price when they acquire it. Tool sales are also reported. These reports are available to the Price Control Division but will also be cataloged by the machine tool section of the production division.

British Combine

Record for England—*Lord Beaverbrook, Britain's Minister of Aircraft Production, indicated last week that plane production had reached an output of 3,200 a month, a new record for England. Both men and women now work around the clock in the production of planes. In a factory in Northern England (above) bombers are produced complete from the raw material stage*

Major General Barnes Urges Tool Engineers to Make Best Use of Present Equipment

DETROIT — Addressing the preview dinner in Convention Hall, March 24, Brig. General G. M. Barnes, assistant chief of industrial service, Ordnance Dept., U. S. Army, told members and guests of the American Society of Tool Engineers that, "This Society could make a great contribution to national defense in assisting manufacturers to find ways and means of securing production with tools at hand, or the tools now in existence." General Barnes outlined the magnitude of the defense task combined with aid to Great Britain under the lend-lease law. The program of the Ordnance Dept. alone will be tripled, he said.

General Barnes was introduced by L. Clayton Hill, vice president of manufacture, Murray Corp. of America. A.S.T.E. President A. H. d'Arcambal greeted visitors on behalf of the Society and commented on its phenomenal growth — 60 per cent within the last 12 months.

The occasion was the Machine & Tool Progress Exhibition held daily from March 25 to March 30 inclusive. Some 250 exhibitors showed new machines, inspection devices, small tools, materials and parts. On Tuesday evening, C. W. Van Ranst, chief aircraft engineer of the Ford Motor Co., stated that the Ford aircraft engine developing 1800-2000 hp. would be ready for production June 1. This is to be a liquid-cooled V-type engine with an exhaust driven super-charger. "Tooling for Fuselage Production" was the subject of a paper by Louis Biehler, assistant chief tool designer, Vultee Aircraft, Inc.

At still another session A.S.T.E. members heard Joseph A. Davies, chief planner and estimator, Naval Gun Factory, speak on "Planning for Production of Naval Ordnance Units." E. M. Sims, president, Metal Forming Corp., told of "Problems of Production of Naval Ordnance Units."

James R. Weaver, manager, Louisville Ordnance Div., and past president A.S.T.E., told of the work the society is doing for industrial training. Other addresses delivered on Education Night, March 27, were "Industry's Need in Skilled Help" by Bartley Whiteside, and "How Connecticut Solved the Industrial Training Problem" by Carl A. Gray, president, the Grenby Mfg. Co.

The annual dinner held March 28 was addressed by Mr. d'Arcambal. L. R. Pennington, assistant to F.B.I. Chief J. Edgar Hoover, talked on how to prevent sabotage.

Among the many exhibits was the Simplex line of precision boring machines made by the Stoker Unit Corporation. These machines have welded bases which makes it possible to supply them in special arrangements. A thread-grinding attachment was displayed by the Dumore Co. This unit has universal adjustment and includes a wheel dresser which can be mounted on the tailstock.

Working models in the Micromatic Hone Corp. booth demonstrated this company's developments in Micr-O-Size control and multi-directional honing.

Hammond Machinery Builders, Inc. showed its new "Dri-n-Wet" abrasive belt surfacer which can be used either horizontally or vertically on wet or dry operations. Another Hammond feature was a carbide wheel grinder combined with a chip breaker grinder. A pneumatic bar feed was displayed by W. C. Lipe, Inc. This self-contained automatic unit eliminates feed fingers, collars, feed chucks.

Two metal-cutting machines were demonstrated by DeWalt Products Corp. The first machine may be used with either of two motor arrangements, one for use with an abrasive wheel, and the other for cutting soft metals with a saw blade. The second machine is for sawing light gage metals.

The Delta Mfg. Co. featured a high speed metal saw for non-ferrous metals. This unit has a speed of 4,000 r.p.m. and is equipped with full angular adjustment.

A new line of electric polishers developed especially for using Osborn brushes was displayed by the Stanley Works. This equipment removes the heat tint left when stainless steel sheet is welded. A heavy-duty honing machine displayed by Enterprise Machine Parts Corp. has a 60-in. stroke with spindle speeds from 35 to 125 r.p.m.

The first of a new line of Vernon universal grinding machines was shown by Machinery Mfg. Co. The motor shaft of this unit carried a grinding wheel at each end with adjustments for angularity and elevation. Sunnen Products Co. displayed a four-speed production portable honing machine.

For drilling hardened steel the Black Drill Co. showed its "Hardsteel" drills having a triangular cross section available in sizes from ⅛ to 1 in.

A special milling machine developed by LeMaire Tool & Mfg. Co., cuts notches in the periphery of aircraft propeller hubs. Known as the "Twin Ram" miller, this machine has a horizontal rotating table and a small milling head advanced radially into the work by two hydraulic rams.

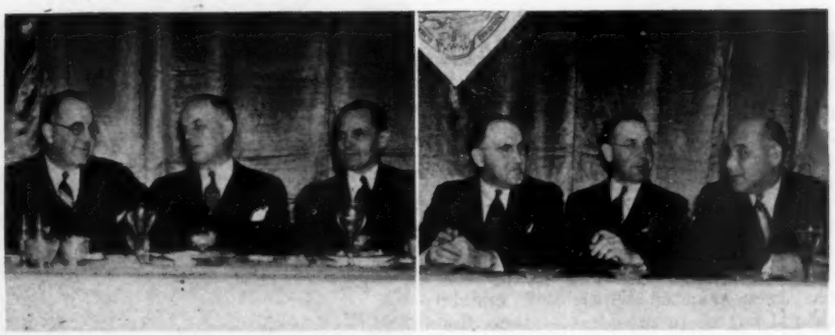
Carboloy Inc. demonstrated a new 14-in. tool grinder built by the Ex-Cell-O Corp. This pedestal type machine is designed for maximum wheel economy. Operating improvements are increased working height and easily adjustable angle protractors.

Optical comparators are put within the reach of smaller shops by two new lines of instruments presented by Jones & Lamson. Both units are available in vertical and horizontal designs and are priced considerably below previous equipment of this kind.

Brown & Sharpe's display featured magnetic appliances. The principle was applied to a rotary chuck, to an improved V-block and to a dial indicator base. All were of the permanent

NEW A.S.T.E. OFFICERS

DETROIT—Frank W. Curtis, chief engineer, Van Norman Machine Tool Co., has been elected president of the American Society of Tool Engineers for 1941-1942. Other officers elected are: O. W. Winter, factory manager, Columbus-McKinnon Chain Corp., first vice president; R. H. Morris, vice president, Hardinge Bros., second vice president; C. L. Hause, sales engineer, Gorham Tool Co., secretary; F. R. Crone, Lincoln Motor Co., reelected treasurer; and F. R. Lamb who continues as executive secretary.



Among those who attended the preview dinner were: A. H. d'Arcambal, president, A.S.T.E.; L. Clayton Hill, vice-president of manufacture, Murray Corp. of America, and toastmaster at the dinner; Brig. Gen. G. M. Barnes, assistant chief, U. S. Ordnance Dept.; Walter F. Wagner, master mechanic, Lincoln Motor Co.; H. J. Robinson, general superintendent, Lincoln Motor Co.; and Ray Raush, general superintendent, River Rouge plant, Ford Motor Co.

magnet design. A multi-purpose electric portable tool shown by H. & H. Research Co. files, hones, burrs, polishes, sands and saws.

Permanent magnetic chucks and fluorescent lighting, coupled with a copious flow of lubricant, are features of the new surface grinder developed by Continental Machines, Inc. The Ultra-Lap Machine Co. displayed two machines especially designed for lapping optical flaps within the limits of twelve millionths of an inch.

Improved tap grinders for chamfering and grinding the flute of two, three and four-fluted taps were displayed by Henry P. Boggis & Co.

Dial snap gages, accurate to 0.0001 in., were demonstrated by the Standard Gage Co. Other features of this company's booth were shock proof dial gages and bore gages using three-point support with two-point measurement.

No less than four new measuring devices based on the Electrolimit principle were shown by the Pratt & Whitney Div. of the Niles-Bement-Pond Co. A standard measuring machine has all control elements in the headstock. A universal internal comparator is set with gage blocks; readings are obtained on a milliammeter. The P. & W. lead tester for precision screws, thread gages and ground taps gives readings on a vernier micrometer dial, while the position of the contact point is checked by an Electrolimit unit. The fourth development is the Electrolimit snap-gage for use on cumbersome parts such as crankshafts.

The Michigan Tool Co. showed an auto recorder in conjunction with its Sine-Line gear tracer. This device transfers readings showing variations from the correct involute to a chart.

B. C. Ames Co. introduced a vertical spindle dial gage for getting into close quarters. Another offering of this company was a caliper gage designed for inspecting shell wall thickness.

Included in the Sheffield Gage Co. display was the "Precisionair" bore gage useful for checking the size and roundness of small and medium caliper guns. Modern "Steeltest" Co. showed a direct reading production hardness tester capable of making 1200 to 2400 readings per hour.

From the West Coast, where many new tooling methods have been born under the impetus of aircraft requirements, comes the new "Autometric" universal jig boring, layout and inspection machine.

An inspection fixture for broaches, especially gun-barrel tools, is new with Illinois Tool Works. The device checks the finish of the broach teeth and the sharpness by a visual method. Rotor Tool has developed a line of small pneumatic die grinders operating at speeds up to 21,000 r.p.m. and using abrasive points or rotary files for cleaning up aircraft-engine parts.

The "Short Wave" three-phase welder developed by Progressive Welder Co. for fabricating sheet aluminum inverts one phase of the current to produce a wave of twice the amplitude of the original. Operation of the electrodes is pneumatic; current control is by equipment of Weltronic Corp.

Oakite Products' booth emphasized the use of cleaning in defense products with particular application to the cleaning of aluminum before anodizing. Also featured was the cleaning of gun parts for rust prevention.

A compact freezing unit shown by Deepfreeze Div., Motor Products Corp., is designed for holding aluminum rivets and parts for expansion fits.

Interested visitors at the A.S.T.E. Metal Progress Show (above) were. W. L. Dolle, president and general manager, the Lodge & Shipley Machine Tool Co.; A. M. Johnson, president, Barnes Drill Co.; E. W. Ristau, vice president, Skilsaw, Inc.; A. C. Pagenstecher, Skilsaw, Inc.; and Bob Hamilton, vice president, Dumore Co.

L. S. Andrich, vice president, Snyder Tool & Engineering Co.; Ray H. Morris, vice president and John McLeod, assistant general manager, Hardinge Bros. Inc.; and E. W. Dickett, proposal engineer, Sundstrand Machine Tool Co. saw much of interest among the exhibits

Philip P. Edwards, vice president, the Ingersoll Milling Machine Co.; James R. Longwell, chief engineer, Carboloy Co.; I. S. McReavy, manager, Small Tool Div., Ingersoll Milling Machine Co.; Edwin R. Smith, vice president and general manager, Seneca Falls Machine Co.; B. E. Hutchinson, vice president, Chrysler Corp., paused a moment at the A.S.T.E. Machine and Tool Progress Show

Plane Production Rises; Need 2000 hp Engines

WASHINGTON—Airplane production in February, on a daily basis, was higher than in January. In spite of the short month, production of combat planes rose from about 400 to about 460. This is made up of about 200 pursuit ships, 25 heavy four-engine bombers, 200 medium twin-engine bombers, and 35 light twin-engine attack bombers. Production of training planes, however was down in February, dropping from about 600 to 415. This was partly due to a shortage of engines in the 450-hp class which handicapped output of Vultee basic trainers.

Shipments of planes to the British, mostly of combat types, totalled 419 in January and, although official figures are not yet available, is believed to have exceeded 450 in February.

Engine production rose even more encouragingly, going up some 300-400 units during January to 3,127 in February. Output of combat size engines (1,000-2,000 hp.) in February is believed to have been about 2,350, as compared with 1,800 in January. Of the February output, some 1,200 went into U. S.-built fighting ships and something like 900 are believed to have gone abroad in crates. Output of Allison liquid-cooled engines now exceeds the number of planes using them, and a substantial reserve is being built up.

The major problem in engines now is output of engines near the 2,000-hp level, which probably amounted in February to something like 600.

Contrasted with U. S., Canadian Industry Is Disrupted by a Small Number of Strikes

MONTREAL—While the number of strikes tend to increase in the U. S., Canada continues to remain free from such disruptions in war industries. Such a record in labor control has been made possible by the Industrial Disputes Act, passed June 1940, and which demands that no strike may be legally called until after the dispute has been referred to a conciliation board. Strikes called before a conciliation board is consulted are not only illegal but are regarded as treason and punishable as such.

The conciliation board is made up of three members, one appointed by employers, one by employees, and a chairman to be agreed upon by the other two members. The board itself is supervised by the government; conciliation follows an approved policy. In general wage increases are correlated with increases in living costs, as measured by the government-cost-of-living index; the index has risen less than 10 per cent since the war. Although labor has the right to bargain collectively, to set up unions, the board's decisions in disputes tend to make strikes non-existent.

The background for Canada's complete control of labor dates back to before the war when unified and long range plans were made. Police organizations listed the names of all known Communists, labor agitators and enemy aliens. When the war started all persons considered public enemies were shipped off quietly to concentration camps. This action has been going on ever since without much publicity. The most serious trouble came last Spring when the Seamen's Union called a strike and tied up traffic on the Great Lakes for a time. It was after this scare that the Industries Disputes Act was passed.

In effect one of the chief reasons for the lack of strikes is that union leaders know that if they attempt to head a strike they will be interned.

A disquieting aspect is that the number of labor disputes which require settlement by a conciliation board has been high. Usually the board has given concessions. In one plant last year wage increases of 35 per cent over the 1936 level were granted. Chief trouble spot is in the metal-working plants where union organizers have been spending heavily to develop dissatisfaction.

At present the situation is becoming more serious. An increasing dissatisfaction is being spread around by organizers who have become more aggressive. Greater pressure is exerted for higher wages and shorter working hours. However once wages start to move upward the government fears that an inflation spiral may begin; further, shortened hours will decrease the effectiveness of the production of war industries.

Although Canada has been successful in averting many strikes in war industries to date, this has been accomplished at the expense of allowing American labor unions take over the control of Canadian unions.

Recent contracts let by the government include: Aircraft: Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, Que., $124,479; Link Mfg. Co. Ltd., Gananoque, Ont., $704,815; and De Havilland Aircraft of Canada, Ltd., Toronto, $767,765. Machinery: Ontario Construction Co. Ltd., St. Catharines, Ont., $362,615. Shipbuilding: Minett-Shields Ltd., Bracebridge, Ont., $170,000; Star Shipyard Ltd., New Westminster, B. C., $152,000; and A. C. Benson Shipyard, Vancouver, $152,000.

Export of Machinery During January, 1941

	January 1941	December 1940	January 1940
Electrical machinery and apparatus	$11,230,651	$9,785,539	$9,369,254
Power-generating machinery, except electric and automotive	2,264,289	2,119,427	1,494,777
Construction and conveying machinery	2,801,445	2,531,130	1,637,647
Mining, well, and pumping machinery	4,036,629	4,262,307	4,254,544
Power-driven metal-working machinery	24,400,387	28,753,334	12,844,084
Other metal-working machinery	1,039,620	815,718	655,533
Textile machinery	1,072,477	768,239	1,006,753
Metal-Working Machinery			
Engine lathes	1,582,573	1,549,800	1,192,423
Turret lathes	1,926,603	1,828,270	768,048
Other lathes	1,318,750	1,882,929	395,324
Vertical boring mills and chucking machines	915,992	1,123,502	602,560
Thread-cutting and automatic screw machines	1,898,860	1,784,117	1,048,600
Knee and column type milling machines	3,137,561	3,406,763	727,579
Other milling machines	2,666,630	3,285,381	1,054,507
Gear-cutting machines	420,118	679,808	573,570
Vertical drilling machines	700,455	595,109	108,115
Radial drilling machines	167,165	303,685	134,494
Other drilling machines	907,428	806,223	281,806
Planers and shapers	922,646	679,189	205,524
Surface grinding machines	613,232	431,581	334,832
External cylindrical grinding machines	859,797	1,076,900	496,233
Internal grinding machines	345,594	1,040,329	713,029
Tool grinding, cutter grinding, and universal grinding machines	776,733	1,030,677	641,767
Other metal-grinding machines and parts	796,615	1,009,180	635,482
Sheet and plate metal-working machines and parts	717,564	1,436,538	587,096
Forging machinery and parts	775,124	1,350,663	413,113
Rolling-mill machinery and parts	1,400,676	1,193,597	1,429,833
Molding machines	19,180	12,103	20,733
Other foundry equipment and parts	167,163	317,011	60,493
Other power-driven metal-working machinery and parts	1,745,499	1,912,531	1,417,347
Pneumatic portable tools	119,635	103,749	186,310
Other portable and hand or foot-operated metal-working machines and parts	176,736	155,251	172,229
Chucks for machine tools	77,343	52,773	31,591
Milling cutters, machine-operated threading dies and tape, and similar machine-operated metal cutting tools	305,471	211,553	128,337
Other metal-working machine tools and parts	360,435	292,392	137,066

U. S. Machinery Exports Decline Seven Per Cent

WASHINGTON—U. S. exports of industrial machinery in January, 1941, were valued at $42,931,123, a 7 per cent decline from the December, 1940, record shipments which amounted to $46,273,141, as reported by the Machinery Division U. S. Department of Commerce. The most important factor in the decreased foreign sales was a decline of more than $4,000,000 in the exports of power driven machinery.

INSIDE DETROIT

Auto production and sales are being maintained near an all-time high despite the fact that manufacturers are tooling up for the mass production of munitions. Producers may lack materials soon

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT — As automobile manufacturers continue to tool up for mass production of munitions, they are maintaining car production and sales at or near an all-time high. Hard upon the heels of an abnormally good February, retail deliveries in March bulged well beyond expectations. Field stocks of certain leading makes dwindled to the point where March production was largely absorbed by current sales.

No abatement in retail demand is foreseen before July. One of the best informed interests feels certain that the auto industry could maintain present peak production until the end of the summer. This can be done without appreciably increasing supply on hand because there exists: (1) an increased purchasing power on the part of labor; and (2) the desire of many thousands of buyers to purchase a new car before curtailment of motor car output is necessitated by diversion of men, materials and facilities to defense and lend-lease munitions.

Fear Lack of Materials

The industry has its fingers crossed about being able to go through the remainder of the 1941-model year without involuntarily cutting back the assembly rate through lack of materials. Sudden scarcities in zinc, aluminum, nickel and manganese are being alleviated, so far as the automobile industry is concerned, by plans to use other materials as fast as substitute part designs can be worked out. For example, Ford Motor Co. reports that "changes already mapped out in the making of automobile parts will mean an 80 per cent saving in nickel, 50 per cent in aluminum and 50 per cent in zinc". Such plans are common throughout the industry. General Motors has undertaken studies on the substitution of low chromium steels for manganese structural steels. But the really big question mark facing motor car plants is ability to obtain steel in sufficient volume to maintain the current U. S. assembly rate, which is hovering around 500,000 units per month. Thirty days ago, it was suggested upon good authority that assembly operations might feel the pinch in steel by May. It now appears that within a week or two one important company will have to decrease operations considerably because it cannot secure sheet steel.

With savings of strategic and critical materials fairly well charted, engineering development work is proceeding. Substitute designs are being transformed into actuality as defense needs encroach upon automobile production. The vice president in charge of engineering of a major company now refers to himself as the vice president in charge of substitutes. To some people this is no jesting matter.

People in the plastics business resent reference to their product as a substitute. The word sounds like using an inferior material in place of something better. The plastics industry believes that the automobile makers will find their product superior to the materials heretofore used. When the emergency is over, they vow that the steel and aluminum companies will have a first-class fight on their hands to regain their automotive markets.

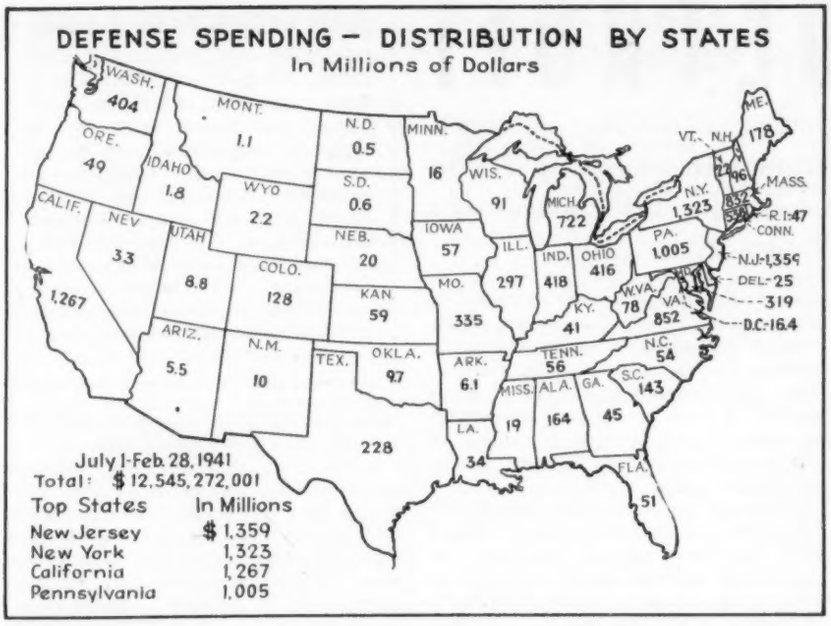
As automobile companies look ahead to the 1942 model year, they are resigned to a lessened output under almost any circumstances. Some makers figure that production will be only 30 to 50 per cent as great as this year's. The reason these estimates are so low is that top executives know it will be almost impossible to swing into full operation on munitions and maintain normal motor car production.

Aside from defense work, there is sound reason for believing that 1942 would be a poorer year than the bumper year which the industry is now enjoying. Automotive history indicates that an especially lush year, particularly when it follows a better-than-normal year, usually robs the succeeding year of some of its volume. This is true now: many buyers are purchasing cars sooner than they normally would because of fear of higher prices and of not being able to get a car when they want one later. The only factor that might upset these calculations is the government's outpouring of unprecedented billions of dollars for defense products. Never before has the federal treasury dumped so much purchasing power into the hands of the American people at one time. The country's purchasing power, at an all-time high, is expected to increase.

SHELL ORDERS TO AUTO FIRMS

DETROIT — Automotive companies, whose shell machining lines have been idle since completing educational orders, will be assigned orders for millions of shell when the new appropriation is distributed soon. Fewer competitive bids and more negotiated contracts are in order. The firms who won the shell orders did so because of lower labor costs. However, these concerns must secure a priority rating in order to buy the necessary equipment.

Steel Instead of Zinc—*To conserve zinc for cartridge brass, motor car manufacturers are stripping zinc die castings from 1941 and 1942 models. Welding manufacturers are now busy working upon set-ups similar to the above Pontiac spot-welding operation used in assembling steel components of radiator grilles*



Defense Spending—*Government contracts awarded from July 1 to February 28, 1941, reached a total of $12,545,274,001. New Jersey topped all states with $1,359,051,132, or 10.8 per cent of the national total. New York was a close second with awards totalling $1,323,475,986, or 10.5 per cent while California contracts amounted to $1,267,070,109 for 10.4 per cent. Pennsylvania, the fourth state to obtain contracts in excess of a billion dollars, had $1,500,426,800, or 8 per cent. These four states combined received 39.4 per cent of all contracts awarded. Eleven Southern States have contracts which total $641,000,000 or 5.1 per cent of the national total. Thirteen mid-western states (west of the Mississippi River) have contracts which total approximately $304,000,000 or 2.4 per cent of the national total. The three Pacific Coast States, California, Oregon and Washington have $1,820,000 of U. S. contracts, or approximately 14.5 per cent of the national total.*

Observers expected that two months would be consumed in legal maneuvering by Ford and union attorneys at hearings before the National Labor Relations Board on the matter of a representation election. While the Ford Co. has not agreed to an election, the way was smoothed for an early labor board decision through the fact that attorneys for the company and the unions reached an early agreement on the major points in stipulations to be presented to the board. If the board rules that an election should be held, it is possible that the final result will be known sometime in May.

It is difficult for neutral observers familiar with labor conditions in Detroit to hazard a definite opinion concerning the status of union strength in the Rouge plant, which employs in the neighborhood of 85,000 workers. At the turn of the year a Ford spokesman asserted that known UAW-CIO strength amounted to 3,000 workers, whereas the AFL craft unions possessed between 8,000-10,000 employees. Under the impetus of strenuous organizing efforts during the first quarter, the situation has changed drastically. Labor reporters are of the opinion that the CIO could win an election if ordered. Mention has been made of the circumstance that the NLRB, which has been investigating the situation for many weeks, ordinarily does not start checking labor's demands for collective bargaining unless it is sure that at least 15 per cent of the workers are union members. Most recent estimates of the union's strength in the Rouge plant run conservatively to 20,000. With the great rank and file voting for a union, as they commonly do, although they may not be union at heart, it would seem that an election could be carried. Work stoppages in key departments are reported.

OPM AIDS SMALL FIRMS

WASHINGTON—OPM is considering a plan to facilitate entrance of smaller firms into munitions production by providing contractors with samples as well as blueprints of items to be produced. Thus smaller shops without much experience in highly technical ordnance drawings can get an idea whether a particular part is within their scope.

SPEED SHIP PROGRAM

WASHINGTON—Last week negotiation of contracts was completed on all 200 of the Maritime Commission's "simplified design" emergency ships to bolster British sea commerce. The American Bureau of Shipping reports that approximately 600 merchant vessels are now building or under contract in the U. S. This includes 60 ships building by Todd yards for the British, the regular standard "C" ship program, and the above-mentioned 200, which are divided among seven contractors. It does not include the additional program for which the Lend-Lease law provides $629,000,000. Nearing enactment is a bill providing authority for the Maritime Commission to negotiated shipbuilding contracts outside of the bidding system; the Commission is the only big procurement agency still confined to bidding, and Chairman Emory S. Land feels that he is at a disadvantage with the Navy in its building program.

Begin Bomber Program; Reuther Plan Rejected

WASHINGTON—The Detroit bomber program, originated by William Knudsen last October has finally reached the stage of actual money for airplanes. Congress has provided a little under a billion dollars to cover the cost of 3,600 bombers to be assembled in four government-owned assembly plants from parts built by auto firms. This represents a year's production, starting in the Spring of 1942. It will cover 1,200 four-engine Consolidated B-24 bombers to be assembled in two plants by the Consolidated and Douglas companies from parts manufactured by Ford. Also included are 1,200 North American two-engine B-25 bombers, for which General Motors will build parts and 1,200 Martin two-engine B-26 bombers for which Chrysler and Goodyear are to build parts. In addition, some 400 firms will be involved as subcontractors to the auto firms; these last will themselves come in as subcontractors to the airplane companies operating the government-owned plants.

Meanwhile, as predicted by AM, the CIO Reuther (500-planes-a-day) plan to use Detroit capacity for aircraft has been definitely rejected. It was rejected squarely on its essential features, treatment of the auto industry as one firm with the work parcelled out in a semi-compulsory fashion, and labor participation in management, rather than on the rather irrelevant arguments as to whether the plan could actually produce 500 planes a day which first greeted Reuther's proposal.

WATCHING WASHINGTON

The President's appointment of a Labor Mediation Board indicates a shift in the settlement of strikes from the union group around Hillman to a New Deal group centered in U. S. Labor Department

By BLAINE STUBBLEFIELD

WASHINGTON — Immediate significance for industry of the President's new mediation board is that it shifts the negotiation of strike settlements from the union group around Hillman to a more or less New Deal group in the Labor Department. This may not look important at first sight until it is remembered that the New Deal is not what it once was; its prime preoccupation now is aid to Britain.

This shift of power is clearly revealed in the details of the mediation machinery set up by the President's executive order, and in the jockeying that accompanied drafting of the order. Hillman wanted the mediation board put into OPM under his thumb. He wanted to have the decision as to what disputes were to be assigned to the board, to get first crack at each dispute himself.

The Labor Department, with whose conciliation service Hillman has been in competition for the past several months, took an opposing line, with strong support from War and Navy departments. Secretary Perkins and John Steelman won out in the last hours before the order was signed.

Mediation Board is Part of OEM

The Mediation Board is set up as part of the Office of Emergency Management, that somewhat nebulous top holding company for all the defense agencies, and is independent of OPM. Labor disputes, as they arise, are handled by the U. S. Conciliation Service and then, if they prove tough, are referred by it to the board. This is the only avenue by which disputes can reach the board.

First actions of the board will be of extreme importance. For one thing the effectiveness of the board is largely dependent on public opinion of it. For another, there is a certain amount of resentment in Congress at the President's by-passing the legislature in setting up the board and considerable suspicion of Perkin's place in the picture. If the board's first actions give rise to any idea that it or the Labor Department is pulling punches, Congress might quite likely go off on its own hook. On the other hand, if some hot disputes are immediately referred to the board and reasonably quick settlements achieved, Congress will lay off the subject for a while, and with a good deal of relief.

From the longer view, legislative prospects of course depend on the development of the strike situation. If strikes continue to increase but the board meanwhile has made a reasonably good showing, legislation will probably take a rather more moderate line than in pending bills, will attempt to strengthen the board by a compulsory waiting period, such as was suggested by Knudsen, to give the board time for its fact-finding and mediation.

Once a dispute gets to the board, it will probably not function as an unwieldy full-size body but will assign three members, one each from labor, management and public, to the problem. Its decisions are not binding but will swing immense weight. The mere power to publicize facts may well prove decisive. Against labor, it has the right to ask NLRB to "expedite as much as possible" decisions on representation cases; this means in effect that the board can force an NLRB election whether the union feels ready for it or not. Against management, there is always the plant seizure power in the background.

Hillman, meanwhile, finds himself largely pushed out of the labor relations picture; he is left with such relatively unexciting jobs as training and labor supply. He will of course try to get back in; already it is reported he is advising the board informally of situations that may require attention.

He has another possibility in his three regional shipbuilding conferences of labor, management, and government which are currently discussing wages and working conditions on the West and East coasts and on the Gulf. If these are successful he can push the pattern they set as an alternative mode of labor control, ultimately perhaps tighter and more effective than the mediation procedure.

The shipbuilding plan, in effect, puts collective bargaining on a regionally industry-wide basis, thus placing negotiations in the hands of the relatively moderate union leaders rather than the local hotheads, and also converting collective bargaining into a three-sided rather than a two-sided affair, with government holding the third hand. The union organizations obtain increased recognition in industry; Bethlehem, for instance, though not willing to participate in the conferences, has agreed to accept their decisions as binding. The government obtains, for the present, uniform wage conditions, no-strike agreements, and elimination of output restrictions. If a war time need should arise for downward adjustment of labor standards, the machinery is at hand; when the time comes the problem will be handled.

Harris & Ewing

Labor Mediation Board—*Met last week for the first time. The members are from left to right (seated): F. P. Graham, president, University of North Carolina; Sidney Hillman; Clarence A. Dykstra, chairman; Daniel Tracy, second assistant Secretary of Labor; W. H. Davis, former chairman N. Y. State Mediation Board; (standing) C. V. McLaughlin, Undersecretary of Labor; Eugene Meyer, publisher, the Washington Post; R. D. Lapham, president, American-Hawaiian Steamship Co.; Cyrus Ching, vice president, U. S. Rubber Corp.; W. C. Teagle, former president, Standard Oil Co. of N. J.; G. M. Harrison, grand president, Brotherhood of Railway and Steamship Clerks; George Meany, general secretary, A. F. of L.; Phillip Murray, president, CIO; and Thomas Kennedy, secretary-treasurer, United Mine Workers*

Army-Navy to Invoke Automatic Priorities

WASHINGTON—A priorities critical list of items on which the Army and Navy Field Service can automatically assign priority ratings has been established by OPM's director of priorities, Stettinius. The priorities division will continue to handle directly the assignment of ratings for items on the critical list, for important civilian projects, and for allocation of materials which must be handled on an industry-wide basis. As in the past, the Munitions Board will administer the assignment of preference ratings to Army and Navy orders for not only prime contracts and first subcontracts, but also subcontracts for items entering into such orders. Some items which appear on the priorities critical list, on which the Army and Navy can automatically assign priority ratings are as follows:

Aircraft, aluminum and its alloys, ammunition, armor plate, boats, boilers, bombs, glass, calipers, cranes, dies, explosives, forgings, generating units, gages, guns, power-driven hammers, hoists, howitzers, jigs and fixtures, locomotives, machine guns, machine and metal-working tools, forging and power-driven machinery, motors, nickel, radio apparatus, rifles, searchlights, ships, small arms, steel, tanks, telephones, tin, precision tools, torpedoes, tractors, trailers, trucks, tungsten-alloy steel and vanadium and its alloys, and zinc.

STEEL INDUSTRY AIDS U. S.

NEW YORK—An Iron and Steel Industry Defense Committee is being organized under chairmanship of B. F. Fairless, president, U.S. Steel, to cooperate with OPM and other government agencies in the national defense effort. It is expected that the committee will include substantially the same membership as the American Iron and Steel Institute. Expediting of production will be the practical goal of the organization. No reply to the bid has yet been mare from Washington.

Will Hold Machine Tool Forum at Westinghouse

EAST PITTSBURGH—The production and design problems in the machine tool industry created by the national defense emergency will be the main theme discussed at the 1941 Machine Tool Electrification Forum to be held on April 14-16 at the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The production problems of the machine tool industry and its responsibilities will be outlined by Howard Dunbar, vice president, Norton Co., who, at present is serving as a member of the Machine Tool Division, National Defense Advisory Committee.

U. S. BUYS BRITISH PLANTS

WASHINGTON — The Defense Plant Corp. has purchased from the British government a powder plant near Memphis, Tenn., costing approximately $25,000,000, and the four machine gun plants, worth approximately $21,000,000, which have been ordered by the British Government from Buffalo Arms Corp., Buffalo, N. Y.; Kelsey-Hayes Wheel Co., Plymouth, Mich.; Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.; and the High Standard Mfg. Co.

February Electric Truck Sales Soar to New Record

CHICAGO—February bookings of electric industrial trucks and tractors were the largest in the history of the industry. During the month a total of 478 units were booked, an increase of about 505 per cent over February, 1940. Total net value of chasses only was $1,441,521, an increase of 399 per cent over the value of bookings in February of last year, as indicated by figures provided by the Industrial Truck Statistical Association, 208 So. LaSalle St., Chicago, Illinois.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $100,000)

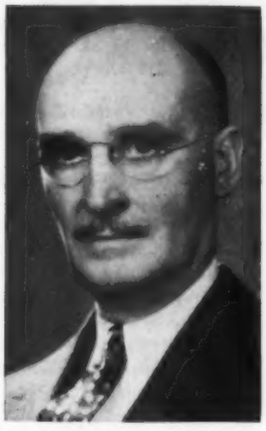
Source	Agency	Commodity	Amount
Ingersoll Milling Machine Co., Rockford, Ill.	War	Milling machines	$175,500
J. K. Welding Co., Inc., Brooklyn, N. Y.	Navy	Floating workshops	491,000
Dekom Shipbuilding Corp., New York, N. Y.	Navy	" "	440,000
Consolidated Machine Tool Co., Rochester, N. Y.	Navy	Planer	113,685
P. Wall Manufacturing Supply Co., Pittsburgh, Pa.	Navy	Bombs	286,960
Thermador Electric Mfg. Co., Los Angeles, Cal.	Navy	Bombs	119,700
Donald Roebling, Clearwater, Fla.	Navy	Amphibian tractors	3,240,000
American Brake Shoe and Foundry Co., Chicago, Ill.	War	Forgings	223,200
American Brass Co., Waterbury, Conn.	War	Small arms ammunition	293,212
New Britain Machine Co., New Britain, Conn.	War	Chucking machines	362,064
W. E. Shipley Machinery Co., Philadelphia, Pa.	War	Shapers and lathes	121,419
Tube Turns, Inc., Louisville, Ky.	War	Shell forgings	675,296
Walter Kidde & Co., Inc., Bloomfield, N. J.	Navy	Steel cylinders	483,779
Benrus Watch Co., Inc., Waterbury, Conn.	War	Fuse parts	105,400
American Brass Co., Waterbury, Conn.	War	Cartridge cups	1,942,063
" " " " "	"	Bullet jacket cups	293,112
Snow & Petrelli Mfg. Co., New Haven, Conn.	Navy	Parts for diesels	180,453
Jack & Heintz, Inc., Bedford, Ohio	Navy	Hand starters	944,400
Bradford Mach. Tool Co., Cincinnati, Ohio	NYA	Lathes	268,125
Buda Co., Harvey, Ill.	Navy	Parts for diesels	143,889
Lidgerwood Mfg. Co., Elizabeth, N. J.	Navy	Mine Crane	180,000
Blackhawk Mfg. Co., Milwaukee, Wis.	War	Jack assys.	264,225
S. A. Woods Mach. Co., Boston, Mass.	War	Shell	2,347,344
Snow Shipyards, Inc., Rockland, Maine	Navy	Minesweepers	604,000
Bendix Aviation Corp., Bendix, N. J.	Navy	Starters	452,520
Fruehauf Trailer Co., Detroit, Mich.	War	Trailers	4,309,306
Atlas-Ansonia Co., New Haven, Conn.	War	Fuse parts	484,000
Westinghouse Elec. & Mfg. Co., Springfield, Mass.	War	" "	944,000
Bridgeport Thermostat Co., Inc., Bridgeport, Conn.	War	Bombs	217,728
Norris Stamping & Mfg. Co., Los Angeles, Calif.	War	Cartridge cases	2,664,000
Titusville Forge Co., Titusville, Pa.	Navy	Forgings	172,152
Westergard Boat Works, Inc., Rockport, Texas	Navy	Hull and fittings	240,628
Albert & J. M. Anderson Mfg. Co., Boston, Mass.	War	Cartridge cases	1,623,930
Hoover Co., North Canton, Ohio	War	Fuse parts	3,923,300
Weatherhead Co., Cleveland, Ohio	War	" "	1,032,000
Fate-Root-Heath Co., Plymouth, Ohio	War	Locomotive	125,250
Davenport Besler Corp., Davenport, Iowa	War	"	125,250
Dutton-Lainson Co., Hastings, Neb.	War	Shell	206,323
Babcock Printing Press Corp., New London, Conn.	War	Machining forgings	607,500
Monarch Machine Tool Co., Sidney, Ohio	War	Lathes	240,109
Bradford Machine Tool Co., Cincinnati, Ohio	War	"	241,735
Warren Steam Pump Co., Warren, Mass.	Navy	Pumps	708,328
DeLaval Steam Turbine Co., Trenton, N. J.	Navy	"	1,350,000
Willys-Overland Motors, Inc., Toledo, Ohio	War	Shell	8,862,040
Pullman Standard Car Mfg. Co., Butler, Pa.	War	Machining shell	1,590,000
Electric Auto-Lite Co., Toledo, Ohio	War	Fuse parts	1,917,006
Scovill Mfg. Co., Waterbury, Conn.	War	Cases; fuses; boosters	6,007,530
Independent Lock Co., Fitchburg, Mass.	War	Fuse parts	965,000
Revere Copper & Brass, Inc., Baltimore, Md.	War	Bullet jacket cups	789,770
Rice Bros. Corp., East Boothbay, Maine	Navy	Hull and fittings	272,800
Fisher Boat Works, Inc., Detroit, Mich.	Navy	" " "	257,000
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.	War	Hoists	151,500
Vulcan Iron Works, Wilkes-Barre, Pa.	War	Locomotive	205,000
American Bosch Corp., Springfield, Mass.	Navy	Engine parts	167,113
Fruehauf Trailer Co., Kansas City, Kansas	War	Trailers	556,950
Rockford Machine Tool Co., Rockford, Ill.	Navy	Shapers	125,850
Kearney & Trecker Corp., West Allis, Wis.	Navy	Milling machs.	118,101
Cincinnati Grinders, Inc., Cincinnati, Ohio	War	Grinders	198,956
Stockham Pipe Fittings Co., Birmingham, Ala.	War	Machining shell	571,200
Beech Aircraft Corp., Wichita, Kan.	War	Airplane parts	1,191,639
Hall-Scott Motor Car Co., Berkeley, Calif.	Navy	Boats	142,233
South Coast Co., Newport Beach, Calif.	Navy	"	206,098
White Motor Co., Cleveland, Ohio	War	Parts for cars	568,248
Eastman Kodak Co., Rochester, N. Y.	War	Height finders	3,544,956
Pheoll Mfg. Co., Chicago, Ill.	Navy	Screws and nuts	153,427
Scovill Mfg. Co., Waterbury, Conn.	War	Fuses	3,780,000
Bohn Aluminum & Brass Corp., Detroit, Mich.	War	Metal fuse parts	339,300
American Brass Co., Waterbury, Conn.	War	Bullet jacket cups	676,854
Taylor Machine Co., Cleveland, Ohio	War	Bomb hoist assys.	219,300
General Bronze Corp., Long Island City, N. Y.	War	Dolly assys.	321,570
Armstrong Cork Co., Pittsburgh, Pa.	War	Machining shell	355,334
Sparks-Withington Co., Jackson, Mich.	War	Bomb hoist assys.	297,000
General Motors Corp., Delco Prod. Div., Dayton, Ohio.	War	Fuse; shell	1,605,737
Enterprise Tool & Gear Corp., Detroit, Mich.	War	Gears and worms	164,085
General Motors Corp. (Chev. Div.), Detroit, Mich.	War	Trucks	523,933
Breeze Corp., Inc., Newark, N. J.	Navy	Engine starters	540,260

Executive Personnel, International Machine Tool Corp. *V-P at Crucible Steel*

C. RUSSELL FELDMANN

E. H. WELKER

E. J. TERRY



RAYMOND E. CHRISTIE

NAMES in the NEWS

Roland A. Ahearn, production manager for 10 years, Billings & Spencer Co., Hartford, Conn., has been elected vice president in charge of production.

A. E. Bateson, who, until a year ago, was manager of purchases, Allis-Chalmers Mfg. Co., has now retired from active service after completing 50 years of association with the company.

William W. Britton has been made special representative, Pacific Coast territory, by the Jessop Steel Co., Washington, Pa.

L. H. Burr, for 17 years production manager, steel fabricating division, Austin Co., has been named works manager. He succeeds the late James E. Ferguson.

Eugene C. Busser has resigned as sales representative, the Cleveland Chain & Mfg. Co. and its associate, David Round & Son. He will take over the Cincinnati offices of the R. E. Condit Co. as manufacturers' agent.

G. M. Carvlen has been named assistant vice president, Koppers Co., Pittsburgh. He joined the company in 1925 as a member of the research department.

Rensselaer W. Clark has been elected president and a director of Hays Mfg. Corp., Chicago. Mr. Clark was formerly vice president, United Aircraft Corp., and was later associated with the National Defense Advisory Commission in the aeronautical section.

Raymond E. Christie has recently been elected vice president and director, Crucible Steel Co. of America, New York, N. Y.

Robert M. Derby, for many years vice president, Niles-Bement-Pond Co., and who retired two years ago, has become affiliated with the Indian Purchasing Mission, British Purchasing Commission in New York.

James S. Duncan, formerly vice president and general manager, has been elected president, Massey-Harris Co., Racine, Wis. and Toronto, Canada. He succeeds the late P. A. Russell. W. K. Hyslop, general manager of the Racine plant, has been named vice president and will remain as the Racine manager.

C. Russell Feldmann and E. H. Welker are president and executive vice president respectively of the International Machine Tool Corp., Elkhart, Ind., the concern which they organized in December, 1940, (AM—Vol. 85 page 262c). E. J. Terry is vice president and general manager; George M. Sundheim is a director and W. H. Foster, formerly president, Foster Machine Co., is the new chairman of the board.

The Millionth Shell—*Produced by Budd Wheel Co., the largest producer of shells for the U. S. Army, is presented to Maj. Gen. Wesson, (right) Chief of Ordnance, by E. G. Budd, president of the company*

John G. Finch has been appointed manager of the LaPorte plant of Allis-Chalmers Mfg. Co. He succeeds C. J. Hood who has retired. Lee H. Hill has been appointed assistant manager, electrical department, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

R. L. Hamilton has been elected vice president, the Dumore Co., Racine, Wis.

A. M. Herrmann has been appointed general factory superintendent, Brillion Iron Works, Inc., Brillion, Wis. For the past 17 years Mr. Herrmann has been with the Belle City Malleable Foundry, Racine, Wis.

Paul Helms has been appointed purchasing agent, Roller-Smith Co., Bethlehem, Pa. He succeeds Harry A. Cassler who resigned April 1.

E. J. McPhee has been appointed general superintendent, Dodge Truck Div., Chrysler Corp. Mr. McPhee has been superintendent of assembly since September, 1938. Formerly he had been chief inspector of production at the Chrysler Corp.'s Highland Park plant.

Charles F. Northup who has had charge of the Syracuse office of Brown & Sharpe of New York, Inc. has retired from active service.

Newton P. Selover has been appointed western sales manager, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

P. K. Povlsen has been named assistant to the president, J. I. Case Co., Racine, Wis.

R. H. Mitchell has been appointed vice president and manager, Killefer Mfg. Corp., Los Angeles, succeeding O. P. Robb, who has retired. The Killefer concern is a subsidiary of Deere & Co.

Col. Carl M. Tichenor has been ap-

pointed executive vice president and general manager, Doyle Machine & Tool Corp., Syracuse, N. Y. Colonel Tichenor was formerly general manager of the Muskegon division, Brunswick Radio Corp.

Guy W. Vaughn, president, Curtiss-Wright Corp., and its subsidiary, Wright Aeronautical Corp., has been elected a director of Western Electric Co.

James M. White has been appointed assistant general works manager, Allis-Chalmers Mfg. Co., Milwaukee, Wis. He was formerly manager of the company's LaPorte works, a post he held for the past six years. He became associated with the company in 1929.

Joseph S. Wilson has been elected president, the Bellanca Aircraft Corp., New Castle, Del. G. M. Bellanca, former president, remains as chairman of the board and consulting engineer.

Frank B. Willis of Bendix Aviation Corp., South Bend, Ind., has been elected president, Automotive Electric Association, for 1941. J. A. Shank, Electric Auto-Lite Co., Toledo, Ohio, has been named vice president and chairman of the manufacturing division.

PLANT EXPANSION

Canadian Sumner Iron Works, Vancouver, B. C., has begun an expansion program which will involve an expenditure of approximately $75,000.

McCulloch Engineering Co., Milwaukee, will erect a new factory building at a cost of $125,000.

Model Sheet Metal Works, Victoria, B. C. will erect an addition to its plant facilities.

Peerless Tool & Engineering Co., Chicago, is erecting an addition to its plant at a cost of $150,000.

Sterling Engine Co., Buffalo, N. Y., has begun work on the construction of a new $500,000 addition to its plant facilities. The new building, providing about 75,000 sq.ft. of floor space, will be ready by September and will be used for the assembling and testing of engines.

The Toledo Steel Products Co., controlled by Thompson Products, Inc., Cleveland, will build a $100,000 addition to its Toledo plant.

The Trumbull Electric Mfg. Co., Plainville, Conn., has increased its plant facilities by the purchase of new factories in Norwood, Ohio, and Plainville, Conn.

The Unitcost Corp., Toledo, will build a $100,000 addition to its present plant to be completed by July 1.

BUSINESS ITEMS

Berlin and Russell Aircraft Machine & Mfg. Co., Los Angeles, has been organized by Charles T. Russell and H. M. Berlin.

Brown Lipe Gear Co., Spicer Mfg. Co., Toledo, has purchased, through its subsidiary the General Drop Forge Co. of Buffalo for approximately $500,000. The new organization will be known as the General Drop Forge Division, Brown Lipe Gear.

Martin Tool & Die Works, Los Angeles, has been organized by Phil B. Martin.

Joseph S. Potts Jr., Richmond, Va., has been appointed representative in that state for Foote Bros. Gear & Machine Corp., Chicago.

Tool Equipment Sales Co., has just been named representative in the Chicago territory for the Lempco Products, Inc.

OBITUARIES

Harry E. Cornell, purchasing agent, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., who has served the company for the past 24 years, died recently.

William W. Crawford, 58, president, Edward Valve & Mfg. Co., East Chicago, died recently. He was a former president of the McClellan Refrigerating Co.

Roderick J. Cant, 75, president of the Lancaster Machine Knife Works, Lancaster, N. Y., died recently.

Edward J. McDonough, president and general manager since 1910, Standard Foundry Co., Hartford, Conn., died recently.

Paul E. McKinney, 56, metallurgical engineer, Bethlehem Steel Co., died recently at his home after a brief illness.

R. M. Sheak, a sales representative, the National Acme Co., Cleveland, died recently.

Gifford K. Simonds, president and general manager of the Simonds Saw & Steel Co., Fitchburg, Mass., died at his home recently at the age of 60. Associated with the Simonds firm since 1898, he also had served as president of the Waltham Watch Co., 1921-22; president of the Hunter Arms Co. at Fulton, N. Y., 1922-24; and from 1924 to 1929 as head of Marschalk & Pratt, New York advertising agency.

Mr. Simonds was a director of the Old Colony Trust Co., Boston; the

Dies at 60

GIFFORD K. SIMONDS

United-Carr Fastener Co. and the Safety Fund National Bank of Fitchburg. A regular contributor to business magazines and reviews, Mr. Simonds was the author of "The American Way to Prosperity" and a series of lectures, "Forecasting for Business".

Addis Emmet McKinstry, president of the International Harvester Co. from December, 1933, to April 1, 1935, died recently at the age of 71. He had been in ill health for the past six years.

His first job was handling repair parts in a branch of the Deering Co., Mansfield, Ohio. In 1902 he was appointed district manager for the Deering Co. for the Eastern U. S. and Canada, and ten years later he was appointed works manager for all Canada and for the Eastern U. S.

MEETINGS

American Gear Manufacturers Association. Annual convention. Hot Springs, Va., the Homestead, May 5–7.

American Iron and Steel Institute. Annual meeting. Waldorf-Astoria, New York, N. Y., May 22.

American Society of Mechanical Engineers. Semi-annual meeting. Kansas City, Mo., June 16–20.

American Society for Metals, Western Metal Congress and Exposition. Pan-Pacific Auditorium, Los Angeles, Cal., May 19–23.

Machine Tool Electrification Forum. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., April 14–16.

National Metal Trades Association. Annual convention. Palmer House, Chicago, Ill., May 8 and 9.

Society of Automotive Engineers. Summer meeting. The Greenbrier, White Sulfur Springs, W. Va., June 1–6.

SHOP EQUIPMENT NEWS

Heppenstall Heavy-Duty Roughing Lathe Manufactured by Lewis Foundry & Machine

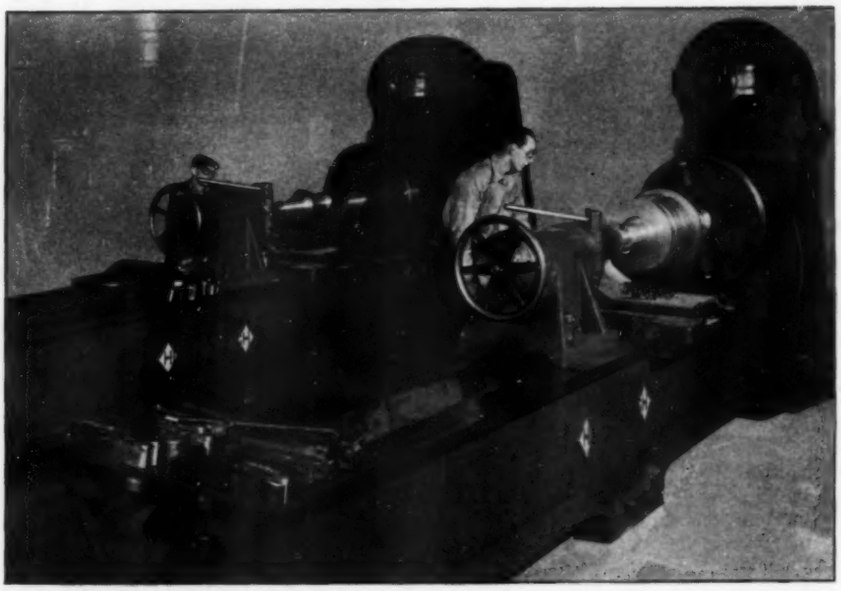
Heppenstall Co., Pittsburgh, Pa., has developed a heavy-duty roughing lathe, for use on forgings and large sections, which will be manufactured by and sold through Lewis Foundry & Machine Div., Blaw-Knox Co., Pittsburgh, Pa. Unusual features of the machine include hydraulic feed, live tailstock center and selective stepless speeds and feeds. The machine has a simplified carriage with hardened wear plates on the bed and cross feed slide. All rotating shafts are mounted on anti-friction bearings.

A small hand lever controls direction of feed. Feed is provided by hydraulic drive through V-belts from the back gear shaft which is constantly in mesh with the main spindle. Any feed can be maintained regardless of a change in the main headstock speed. A start and stop button for the main motor is mounted on the carriage. A start button for the rapid traverse, which operates only when depressed, is also mounted on the carriage. Electrical connections to the carriage are made through a reel.

The bed is a heavy box section semi-steel casting with cross-ties. Plate type ways are covered with hardened steel wearing plates. Faceplate is of cast steel, with a specially designed chuck and a forged steel spindle for the drive. All headstock drive shafts are equipped with antifriction bearings, lubricated with a separate motor-driven lubricating pump. Tailstock is of the Heppenstall patented live center type and is equipped with ball and roller bearings and a means of absorbing end thrust. All carriage castings are of steel.

The main headstock bearings and gears are lubricated by a motor operated pump. Bearings for the feed shaft are equipped with Zerk fittings. The tailstock is equipped with an oil fitting and is lubricated with absorbed oil. Electrical equipment includes a main drive motor of 25 to 30 hp., 300 1200 r.p.m.; a 1200 r.p.m., 3-hp. power rapid traverse motor; a ⅓-hp., lubricating pump motor; and a Gleason reel and main control for the large drive motor.

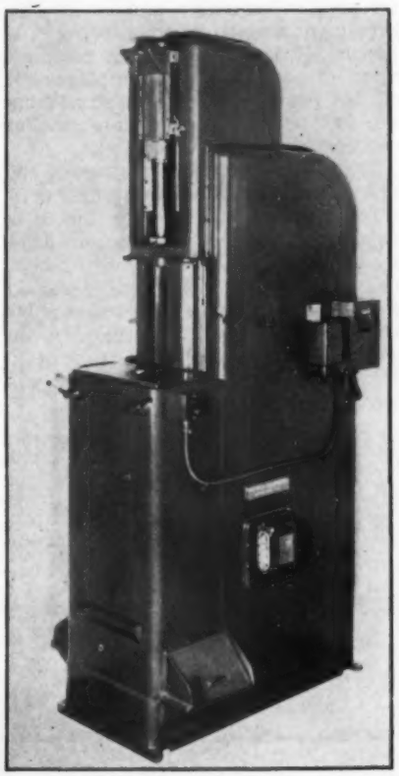
Specifications: maximum over-all length, 32 ft.; maximum width, 56 in.; swing over bed, 36 in.; swing over carriage, 20 in.; maximum distance between centers, 20 ft.; height of centers above bed, 16 in.; width of bed, 32 in.; depth of bed, 30 in.; spindle speed, 10 to 40 and 40 to 160 r.p.m.; feeds, from 0.020 to 0.450 in.; weight approximately 36,000 lb.



Colonial Pull-Down Broaches Made in Standard Sizes

Heretofore available only on special order and in a limited number of sizes, pull-down broaching machines made by Colonial Broach Co., 147 Jos. Campau St., Detroit, Mich., are now offered in standard sizes ranging from 3 to 20 tons capacity and from 24 to 60-in. strokes. Larger tonnages also can be obtained on order.

These machines are said to be especially advantageous under conditions where damage may result from the dropping of machined pieces, as in the manufacture of precision parts. Since the part to be broached lies flat on the platen, or is held in a fixture mounted on the flat platen, pull-down machines are also especially suitable where indexing of the part to the broach is necessary, as when locating a splined hole relative to the teeth of a gear.



Machines provide completely automatic handling of the broach through a hydraulic handling mechanism located at the top of the column. It is not necessary for the operator to touch the broach at any time. In the operating cycle the broach is held at the top of its stroke by the handling mechanism and is uncoupled at the bottom to permit placing the part in position on the platen. As soon as the pilot on the broach passes through the part, the broach is automatically attached to the pull-down mechanism and is uncoupled at the top. After the part is

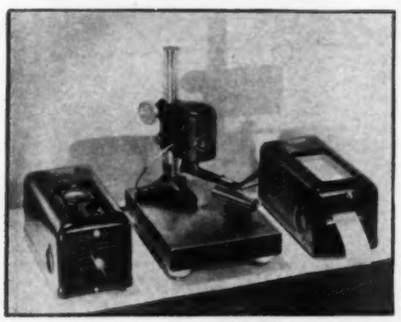
removed, the broach is pushed upward when desired by the operator, until it engages in the cup of the automatic handling mechanism. It is then returned to the top of the stroke, ready for the insertion of the next part to be broached.

The machines follow regular Colonial welded steel construction. Length of stroke is adjusted by stops on the column. Manual operation is standard. Drive is hydraulic, fully inclosed. Speeds are variable, normally 30 ft. per min. down and 60 ft. per min. on the return stroke.

Brush Surface Analyzer Features Improved Performance

An improvement over previous models, the No. SA-2 surface analyzer offered by Brush Development Co., 3311-25 Perkins Ave., Cleveland, Ohio, is built for greater versatility and longer life. Prominent among its improvements is the use of a diamond tracer point instead of sapphire, and the placement of this point ahead of the positioning shoe to permit checking into smaller corners, such as in gear teeth.

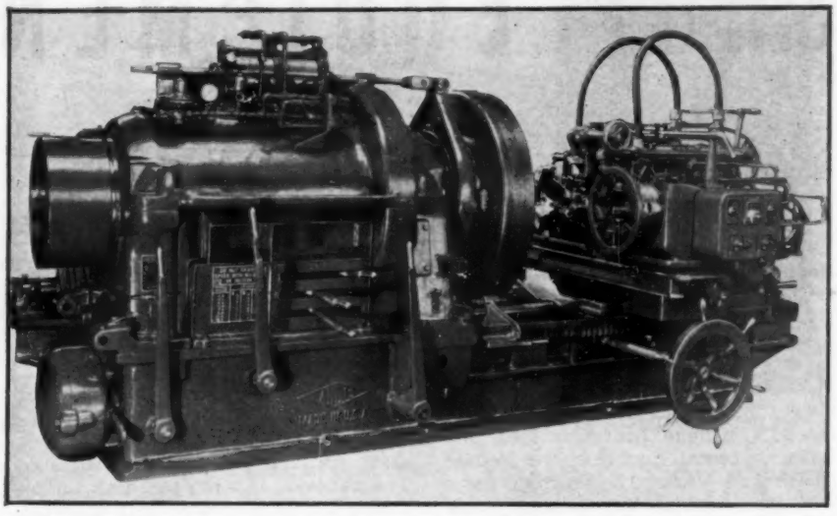
The drive head, which operates the pickup arm, has a self-contained synchronous motor. Heretofore, the drive head was operated by a flexible drive shaft connected to the chart motor. Length of trace has been increased from 0.050 to 0.060 in. The tracer point is driven at a uniform velocity, in which one complete cycle requires 10 sec. Heretofore the tracer point was



driven in a simple harmonic motion in which one cycle required 15 sec. Electrical circuits have also been improved to minimize effects of line voltage fluctuations and to insure greater accuracy.

The following accessories have been designed for use with the Model SA-2 analyzer: A meter attachment, which provides a visual indication of the average height of irregularities; the PA-3 pickup arm, designed primarily for laboratory and research purposes, where are extremely fine tracer point is required; an extension arm, which permits measurement of deep bores up to a maximum depth of 12 in.; and a glass calibration standard for use in checking undue wear of the tracer point, and for periodical checkups of over-all calibration.

Landis Bomb Turning and Threading Machine Completely Finishes Ends at One Chucking



Tail ends of bombs can be completely finished at one chucking with the special bomb turning and threading machine developed by Landis Machine Co., Waynesboro, Pa. In this machine three tool units are attached to a carriage and cross slide for turning, facing, chamfering, boring, recessing and threading operations.

One tool unit, consisting of a tool head with four tangential type cutters and attached to a hydraulically controlled slide, turns, faces and chamfers the end of the bomb. A second unit has a hydraulically controlled slide to which is attached an adjustable six-blade cutter head for finishing the bore, and an auxiliary hand-operated tool slide for machining the angular face and undercutting on the body of the bomb and the adjacent recess. The third tool unit, attached in a fixed position to the cross slide, comprises a Landis 40 AX "Landmatic" die head especially designed for cutting fine pitch threads on large diameters. A leadscrew mechanism is provided in conjunction with the die head.

All movements of the tool slides as well as those of the cross slide are hydraulically controlled with circuits arranged with interlocks to assure correct operating sequences. The cross slide is hydraulically locked in position when any of the tool slides is in action. The operating controls are conveniently centralized at the front of the machine, providing the operator full control from a position permitting observation of the tools in action throughout the entire machining cycle. Machine is equipped with a variable-speed motor-driven headstock which includes a selective sliding gear transmission. This transmission provides eight speed ranges for almost infinite variations from minimum to maximum. A pneumatically operated chuck is attached to the front end of the machine spindle for centering and driving the bomb.

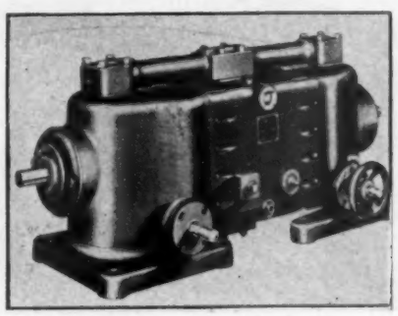
The bed on which the geared headstock is mounted has guarded renewable cast iron ways for the carriage. The leadscrew mechanism is mounted in the bed and is equipped with a pick-off geared drive for a range of 6 to 14 threads per inch. A leadscrew thread indicator is built into the carriage.

Vickers Hydraulic Transmissions Provide Variable Speeds

A compact self-contained hydraulic unit for smooth control of rotary power is provided in this variable speed transmission developed by Vickers, Inc., 1400 Oakman Blvd., Detroit, Mich.

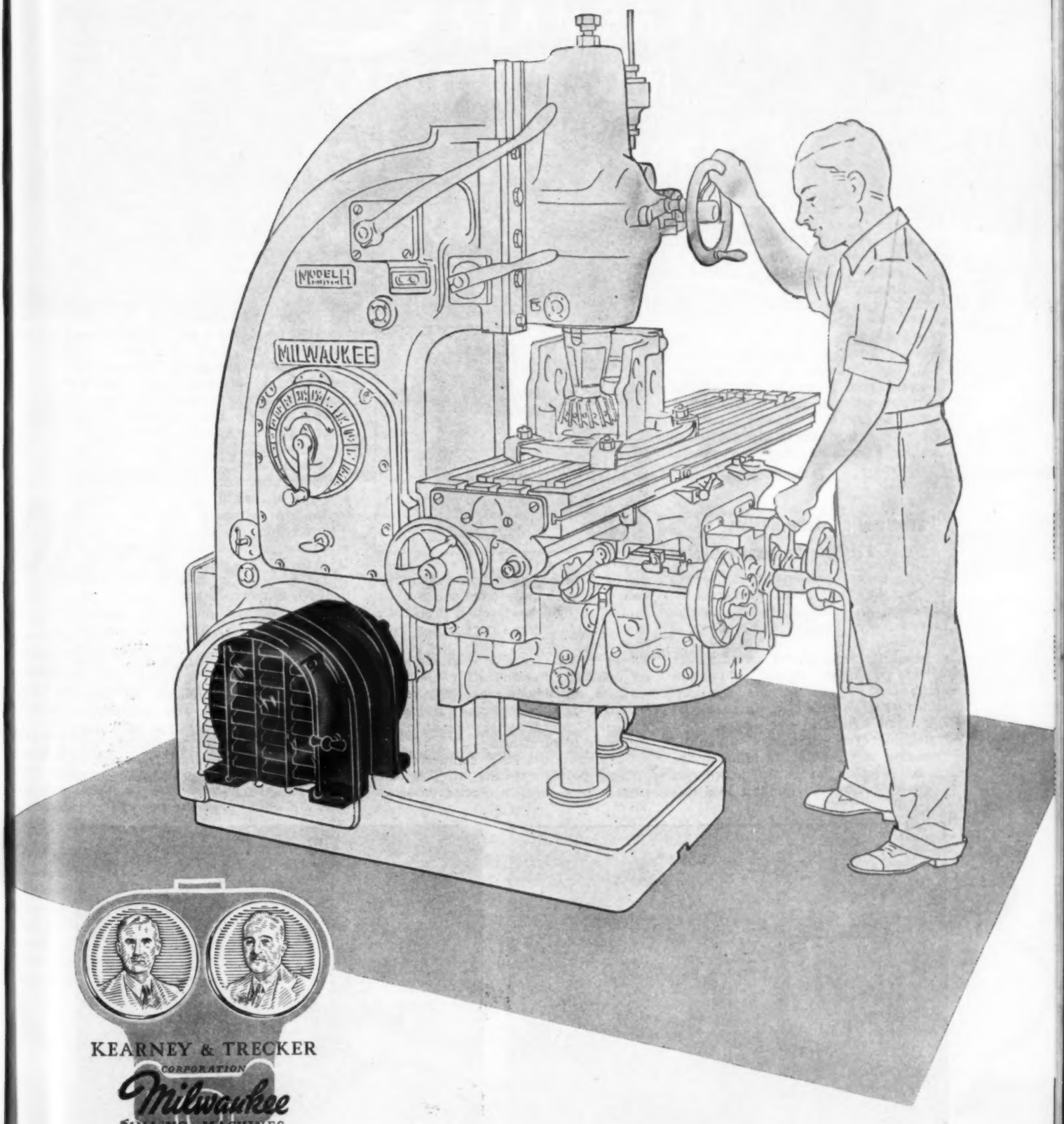
Standard Vickers variable delivery pumps and variable displacement fluid motors in a wide range of sizes are combined to provide an almost infinite variety of operating ranges for power transmission units of 2 to 300 hp. Designed to operate quietly and at an exceptionally high efficiency at high pressure, these transmissions provide a flexible and economical installation.

The unit provides means for smooth start and stop, reverse, overload protection and stepless speed control when arranged between a constant-speed prime mover and the driven machine. Various types of manual and automatic control arrangements are available for use with these transmissions.



Cross-mounting of the motor contributes substantially to the rigidity of Milwaukee Milling Machines and assures a smooth, vibration-free flow of power at all speeds and feeds. Side-mounting permits machine to be placed back-to-wall.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.



KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

MILWAUKEE MILLING MACHINES

"Aircraft Special" Welder Suitable for Light Work

Hobart Brothers Co., Troy, Ohio, has developed the "Aircraft Special" motor-generator d.c. arc welder especially for production welding in the aircraft field. This welder provides high striking voltage that makes possible the exceptionally hot start required in welding light gage alloys of the type generally used for aircraft construction. The welding range is from 15 to 125 amp., or 100 amp. continuous service.

Although known as the "Aircraft Special," this welder is also suitable for application of light gage welding. It can be used successfully in connection with certain operations involved in welding galvanized steel and general light work.

"Parkermatic" Tube Bender Employs Automatic Cycles

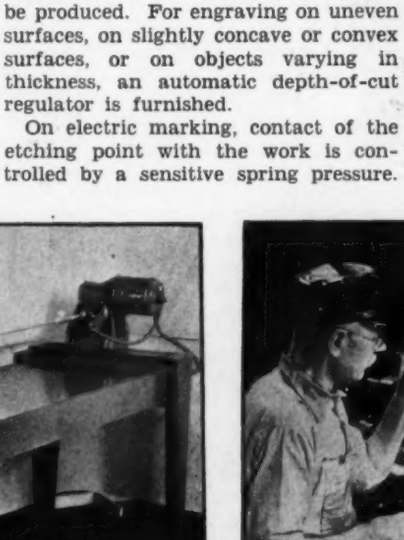
Automatic bending and return cycles are employed in the 'Parkermatic" power-driven bending machine manufactured by Parker Appliance Co., Cleveland, Ohio. While this machine is primarily designed for bending 3-in. outside diameter copper, aluminum alloy, and 2½-in. outside diameter annealed steel tubing, it can also bend equivalent structural steel shapes.

Bending cycle consists of automatic clamping of material, bending, automatic stopping at a predetermined angle, extraction of mandrel, and unclamping. Return cycle is the simultaneous return of mandrel and bending accessories to starting position. Change-over from left- to right-hand bending can be made quickly. Correct rotation is automatically established by a switch actuated by the position of the arms. It is said that a production of 250 right angle bends per hour is easily attained with the machine.

Combined Engraver and Etcher Made Available by Preis

A combination bench-type pantographic machine for general industrial engraving on all materials, and electric etching on soft or hardened steel, has been introduced by H. P. Preis Engraving Machine Co., 157 Summit St., Newark, N. J. Separate heads, quickly interchangeable, are used for the two classes of work.

On engraving work, depth of cut is controlled independently of the depth of master characters by a micrometer adjustment mechanism on the engraving head. Movement of the engraving cutter, to and away from the work, is controlled by a cam-action drop lever, thus eliminating the necessity of raising and lowering the pantograph. Either raised or sunk engraving can be produced. For engraving on uneven surfaces, on slightly concave or convex surfaces, or on objects varying in thickness, an automatic depth-of-cut regulator is furnished.



On electric marking, contact of the etching point with the work is controlled by a sensitive spring pressure. The etching point may be removed from its fixture and used as a hand-etching pencil for rough or freehand marking. A transformer provides three or more voltages for various depths of marking.

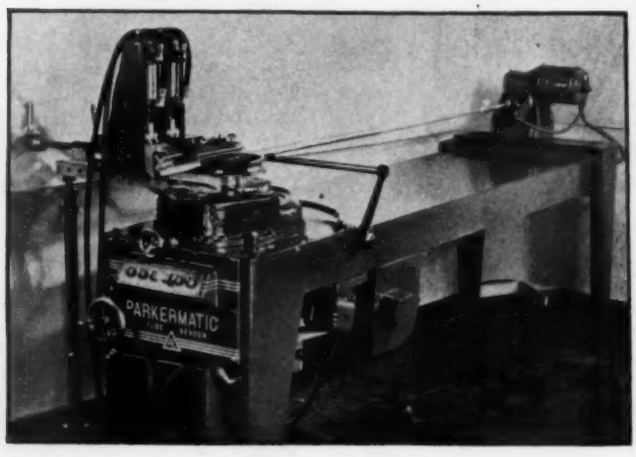
South Bend Bench Lathes Accomodate Small Work

Model A 9-in. swing toolroom precision lathe announced by South Bend Lathe Works, South Bend, Ind., is said to be well adapted for small diameter work requiring a high degree of accuracy and sensitivity. This lathe has a maximum collet capacity of ½ in., maximum swing over bed ways of 9⅛ in., and a maximum swing over saddle cross slide of 5½ in. Three bed lengths are available, providing center distances of 16, 22 and 28 in.

Twelve spindle speeds from 41 to 1,270 r.p.m. are provided on motor drive models. Smooth operation at high speeds is attained by using a direct belt to the spindle for speeds above 400 r.p.m. A wrenchless bull gear lock permits engaging the back gears quickly.

A series of 48 power longitudinal feeds, 48 power cross feeds and 48 pitches of screw threads, right or left hand, are provided by the quick-change gear mechanism. Full automatic apron is equipped with a worm drive and friction clutch for operating both the automatic power cross feeds and the automatic power longitudinal feeds. An automatic interlock makes it impossible to engage the half nuts when the power carriage feeds are in use.

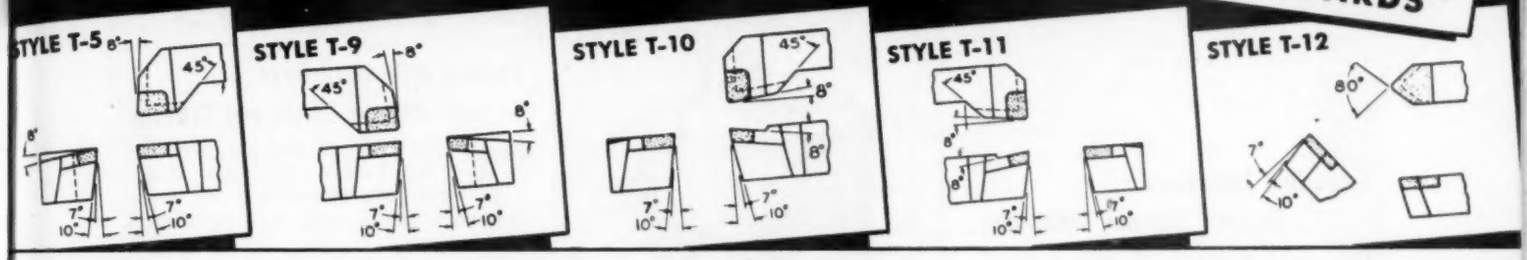
Equipment supplied with this lathe includes handwheel type draw-in collect chuck, collet rack, taper attachment, thread dial indicator, micrometer carriage stop, and chip pan. Other attachments supplied to order include an electric grinding attachment, milling attachment, oil pump and piping, chucks and accessories. Lathe is made in floor type with pedestal motor drive, as illustrated, also in bench type with motor drive, and in both bench and floor types with countershaft drive.



Announcing

5 NEW STANDARD CARBOLOY TOOLS NOW BEING ADDED TO STOCK!

Prompt Delivery! ON ALL "STANDARDS"



Plus REDUCED SCALE OF PRICES ON PRESENT STANDARD TOOLS

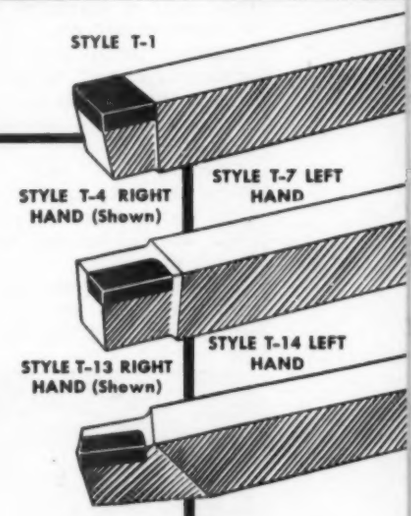
Six months ago . . . a NEW plan introduced . . . a line of standard, "universal-use" Carboloy tools, produced in large quantities—low priced—and maintained in stock for prompt deliveries.

Today—with a record of thousands of tools shipped from stock weekly for 24 weeks in continuously increasing quantities—that plan has proved itself an outstanding success and the answer to the pyramiding demand for carbide tools.

To further extend the benefits of standardization for the user we are now supplementing the original 5 standard styles with 5 new styles—in 21 sizes. These are also being produced in large quantities to be stocked for prompt delivery. They consist of right- and left-hand offset turning and facing tools, and a "rounded" nose, two-way turning tool.

Coincident with this expansion—prices of the original 5 standard tools have been revised. Reduced prices are in effect for the entire standard tool line with the exception of minimum prices on sizes up to ¾" square. Quantities necessary to obtain minimum prices have been reduced from 50 tools to 10, and, in some cases, 5 tools. Substantial reductions affect price per tool in quantities of 1, 2-4, and 5-9.

With these new, lower prices, and this augmented line of 10 standard styles—NOW—more than ever before, you will find Carboloy Standard Tools your answer to carbide use . . . applicable to at least 80% of all turning, facing, boring jobs on ALL metals and nonmetallics! Write for new catalog GT-129 today.



for STEEL CUTTING

Standard tools styles T-4, T-7, T-5, T-9, T-13 and T-14 tipped with Carboloy Standard Grade 78B for machining steel, are furnished with ground-in chip breaker as shown below.

CARBOLOY COMPANY, INC., 11149 E. 8 MILE STREET, DETROIT, MICH.

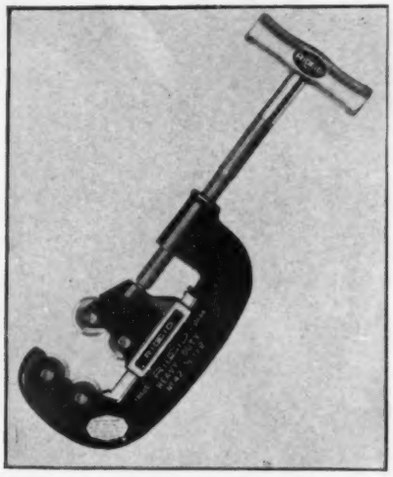
Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Worcester, Mass.

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

Reg. U.S. Pat. Off. Mark of CARBOLOY

CARBOLOY STANDARD TOOLS

Send for New Catalog GT-129



"Ridgid" Pipe Cutters Operate in Close Quarters

Ridge Tool Co., Elyria, Ohio, has developed the No. 42 "Ridgid" pipe tool especially for operation in close quarters. This special handle 4-wheel model is said to provide better balance and handling of the cutter under all conditions and to cut more evenly and save time in cutting iron, steel or brass pipe. The frame is of malleable alloy. Capacity is ½ to 2 in.

Ames Dial Indicators Feature Extreme Sensitivity

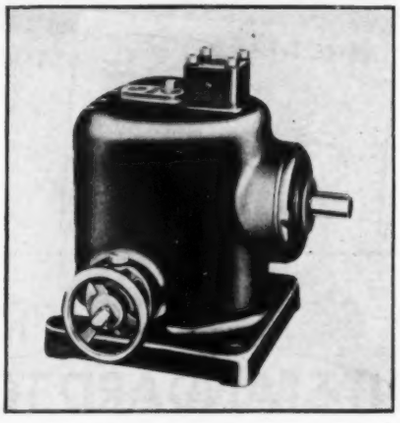
Four sizes of indicators with a choice of fourteen different dial numberings indicating tenths of thousandths, half thousandths, and thousandths of the inch or thousandths and hundredths of millimeters are available in the "Hundred Series" dial indicators offered by B. C. Ames Co., Waltham, Mass. In these indicators all dimensions and characteristics comply with those adopted by the American Gage Design Committee.

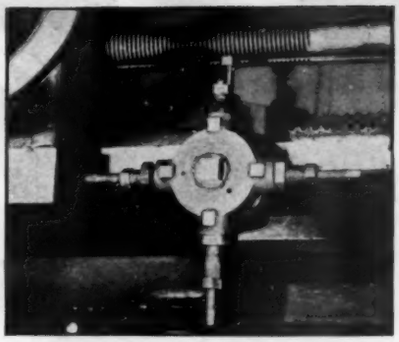
Jeweled indicators have jewel bearings for every staff, including the center pinion. Either jeweled or plain bearings are available in all models. A shockless wheel assembly which protects the movement from damage by hard usage can be supplied in place of the regular wheel assembly. Extreme accuracy and sensitivity are said to be outstanding characteristics of these indicators. Easy-to-read dials and chromium finish are also features.

Vickers Pumps and Motors Operate at High Pressures

High volumetric and mechanical efficiencies at high pressures are features of a series of rotary piston pumps and motors developed by Vickers, Inc., 1400 Oakman Blvd., Detroit, Mich. Designed to operate at standard motor speeds, pumps are available in sizes ranging from 3 to 300 gal. per min., and for operating pressures up to 3,000 lb. per sq. in. The pumping mechanism is self-contained within an oil-tight housing arranged for either foot or face mounting.

For operation at exceptionally high rotative speeds and at pressures up to 1,500 lb. per sq.in., motors provide a compact unit for development of rotary mechanical power from fluid pressure. Available in both foot and face mounting arrangements in sizes from 3 to 300 hp., they may be mounted in the most convenient location to eliminate mechanical power transmission equipment such as gears, clutches, shafts, etc. They are readily reversible and also may be stalled indefinitely under load without damage. Various manual and automotive volume control arrangements are available to control torque and speed as may be required, either directly or from a remote control station.





"Quadruplex" Tool Stop Helps Cut Machining Time

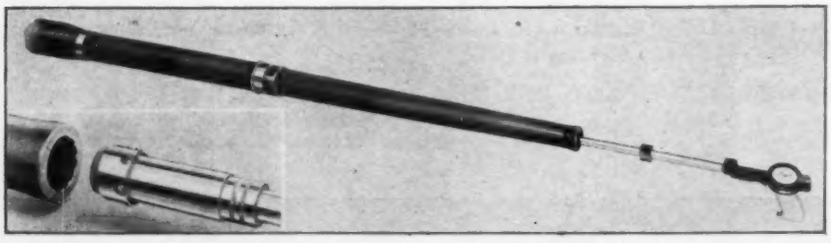
Machining time is reduced and tool versatility is increased with the "Quadruplex" stop developed by Specialties Mfg. Co., 35 Farrand St., Bloomfield, N. J. This device can be attached to engine lathes, milling machines, boring mills, etc., in the same manner as the conventional micrometer stop.

To set any of the four stop screws, a micrometer depth gage is employed. Detent pins hold the stop accurately in all four positions.

Federal Rifle Bore Gage Checks Lands and Grooves

Model G3F P-28 rifle and gun gage developed by Federal Products Corp., 1144 Eddy St., Providence, R. I., is especially useful in checking both lands and grooves of gun barrel rifling. Shown in use inspecting a 37-mm. anti-aircraft gun, the head of this instrument consists of three sensitive contact points, and three guide points. The entire head revolves so that the guide points can rotate the head as the gage passes through the barrel. Thus the contact points follow the grooves and check for diameter, out-of-roundness and taper. The lands of the gun barrel can also be checked the same way, the guide points preventing the contact points from slipping off the lands into the grooves.

At intermediate points, depending upon the length of the barrel to be inspected, wooden supporting collars are used to keep the gage in alignment and yet free enough to float. The barrel of the gage itself is graduated in inches so that the inspector can determine depth of checking at any time. Contact points are contracted simply by pulling on a trigger beneath the dial indicator. The gage is claimed to repeat faithfully.



Revere Copper and Brass Incorporated

Executive Offices
230 Park Avenue
New York

C. Donald Dallas
President

To American Industry:

Virtually the whole production of Revere Copper and Brass today is directed toward arming the nation and the allies of democracy beyond its borders.

We do not make tanks or ships, fighting planes or machine guns. But without the products we do make, these would be useless. Every bullet, every shell and every cartridge needs copper or brass or the other copper base alloys——so do torpedo heads and army field kitchens——condensers of battleships and oil coolers of fighting planes.

It is our first task to insure an unfailing supply of metal products vital to defense.

In addition to this grave new responsibility, we recognize our long established responsibility to our old customers. And so we are gearing our defense tasks to allow the best possible production for non-defense too. But there are many cases where it is not possible to do both.

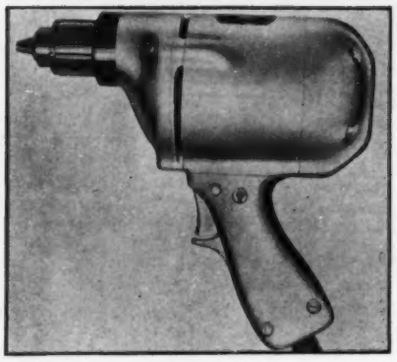
Revere, however, has always rendered service to its customers beyond the mere supplying of metal. And, even though we may not be able, in some cases, to supply the metal you ask for, we would still like you to call for these services——to use, at no cost or obligation, our vast file of data on copper and its alloys and our Technical Advisory staff. It may be that we can cooperate with you in suggesting ways for you to replace metals or alloys needed for defense by other metals or alloys, equally efficient and immediately available.

Sincerely yours,

C. Donald Dallas

C. Donald Dallas

APRIL 2, 1941



Black & Decker 1/4-in. Drill Equipped With Ball Bearings

Black & Decker Mfg. Co., Towson, Md., has introduced a standard ¼-in. ball-bearing portable drill to combine high power, compactness and light weight in a practical production drill. It is equipped with anti-friction bearings throughout, splined gear mounting, locked inner and outer races on spindle bearing, and removable commutator end cover.

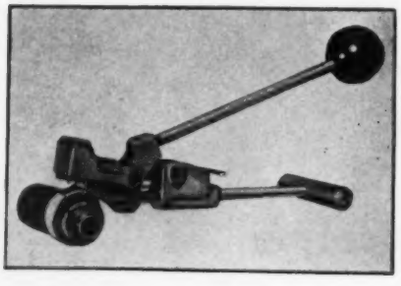
This drill is said to be particularly adapted to aircraft work, as it has a full range of spindle speeds to meet aircraft production requirements. It is made with a close offset and available with a choice of end or side handles. Drilling capacity of steel is ¼ in. Standard speed is 2,000 r.p.m., but models with speeds of 3,500 and 5,000 r.p.m. are also available.

"Punch-Lok" Hose Clamp Presents Smooth Surface

A clamp claimed to be as smooth as the hose itself has been developed by Punch-Lok Co., 430 N. Wolcott Ave., Chicago, Ill. Applied with a special tool, this clamp is intended for high-pressure couplings subject to vibration or rough handling.

The clamp consists of superimposed wraps of steel bands ⅝ in. wide, formed into a circle and held by a special clip arranged to lock the bands after the clamp has been put under pressure. It is said that the hose is compressed evenly all the way round, and if used with special connectors and nipples will result in a joint as strong as the hose itself.

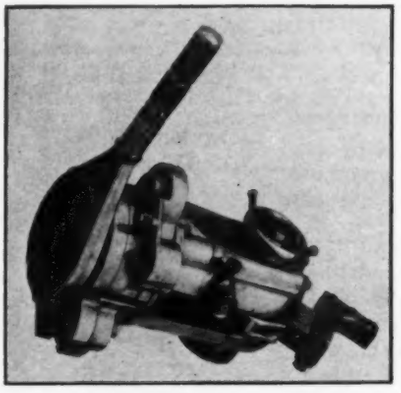
The special tool to apply these clamps weighs 2½ lb. It may be used in the hand or fitted to the bench. It applies clamps to hose from ½ to 3 in.



Universal Machine Head Finishes Unwieldy Shapes

Complicated internal surfaces on awkward, bulky parts can be finished with the Universal machine head developed by John Kis, 2028 Phillips Ave., Racine, Wis. This head, which is particularly applicable to horizontal boring mills, vertical boring mills and jig borers, revolves with the spindle while the work is held stationary.

The head permits taper boring, taper turning, facing, backfacing, beveling, grooving, radius boring, straight boring, counterboring, undercutting, turning and recessing. All motions of the cutting tool are controlled by the set-up of the device. Thus, it performs an extremely complicated sequence of operations with only one machine set-up.



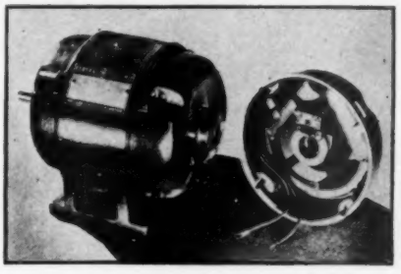
Feed of the head is independent of the speed of the machine spindle, as the motion of the sliding bar is controlled by gearing encased in the head. The only mechanism which remains stationary is the operating handle which stops or releases the sliding bar while the head is in motion. A handwheel permits rapid movement of this bar.

G.E. "Tri-Clad" Motor Made in Capacitor Types

As an extension of its recently announced line of "Tri-Clad" polyphase induction motors, General Electric Co., Schenectady, N. Y., offers a "Tri-Clad" capacitor motor designed to meet a large number of varied industrial applications. Like the polyphase motor, this capacitor motor features modern appearance and better mechanical and electrical protection, as well as protection against operating wear and tear.

This motor may be obtained with either ball-bearing or sleeve-bearing construction, and is available in two types, Type KC and Type KCJ. Type KC is designed particularly for applications requiring moderate starting torques such as fans, blowers, and centrifugal pumps. Type KCJ is designed for compressors, loaded conveyors, reciprocating pumps, and other applications requiring high starting torque. Capacitors are mounted inside the end shield on the normal-torque motor, while on the high-starting torque motor, 1½-hp. and larger, the capacitors are mounted in a compact case on top of the motor frame.

In both forms, the capacitor motor

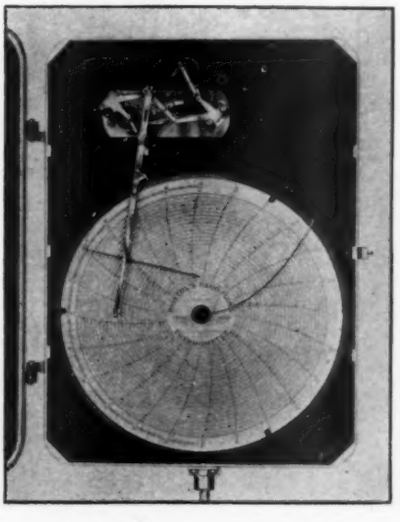


incorporates all of the protective features of the "Tri-Clad" line: complete mechanical protection through the use of a cast-iron frame, electric protection made possible by the use of "Formex" wire in the magnet coils, and improved bearing design and lubricating arrangements. It also utilizes the cast-aluminum rotor and double-end ventilation.

Bristol Recording Thermometer Provides Greater Sensitivity

Bristol Co., Waterbury, Conn., has developed two new recording thermometers of the liquid filled type, known as the case-compensated Class I recording thermometer and the fully compensated Class I recording thermometer. Improved design and construction of the measuring elements, tubing and bulbs in these instruments extend the field of application of the liquid filled thermometer, making it possible to take advantage of the desirable characteristics of the Class I thermometer or system on a greater variety of temperature-measuring problems.

The case-compensated instrument is



offered in temperature ranges up to 400 F. and tubing lengths up to 10 ft. or longer, depending on conditions surrounding the installation. The fully compensated thermometer may be had in ranges up to 400 F. equipped with 200 ft. or less of connecting tubing between the instrument and the bulb.

These thermometers are said to have higher sensitivity and accuracy. The improved measuring element is considerably stronger and more powerful than previous designs. They give uniformly accurate results over a wide range of change in temperature along the tubing and in the case.

Multiple V-Belt Drives Made by Cincinnati Rubber

Cincinnati Rubber Mfg. Co., Cincinnati, Ohio, has developed a line of multiple V-belts for a wide power range. Construction of these belts is claimed to contribute definite advantages of smooth running, long life and resistance to fatigue. A heavy elastic fabric envelope takes up outside wear and permits ready flexing and holds tightly to the groove. Load is carried by a cord section of high tensile, low stretch cords thoroughly impregnated with liquid rubber and imbedded in a cushion of rubber providing lengthwise flexibility and easy flexing around the pulleys. Each belt in a set is matched so that it will carry its share of the load.

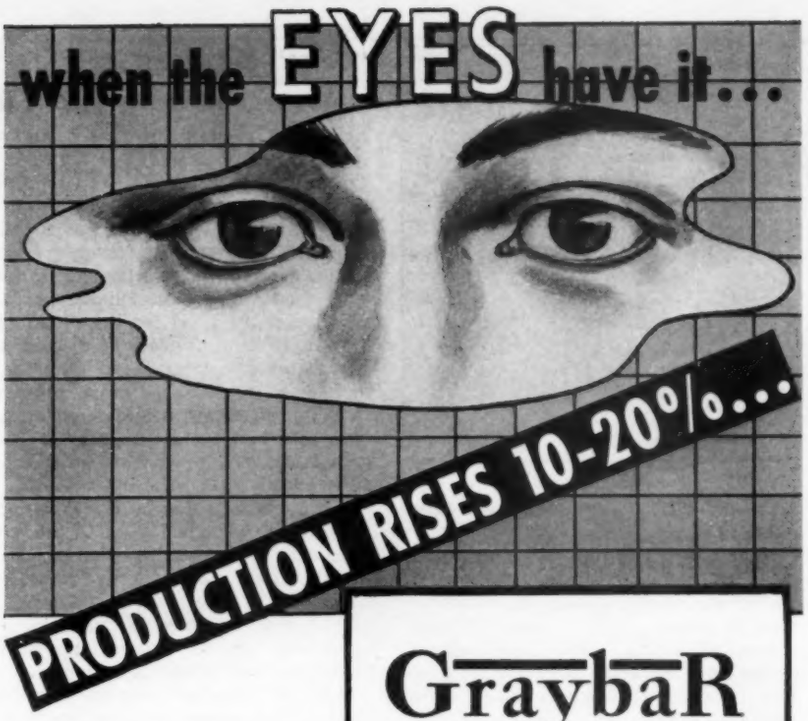
"Postex" Blue Line Paper Uses Dry Development Process

"Postex" blue line paper, suitable for use with white print dry developer or ammonia vapor machines, has been improved by Frederick Post Co., Box 803, Chicago, Ill. This paper has a 50 per cent rag content bond, two sensitivity speeds and two colors. It is claimed to print out to a cleaner, whiter background and at the same time to leave all lines in deeply colored contrast.

Baker Center Control Truck Handles 2,000, 3,000-lb. Loads

An addition to the line of industrial trucks manufactured by Baker Industrial Truck Div., Baker-Raulang Co., 2168 W. 25th St., Cleveland, Ohio, is its Type JOM center-control fork truck, available in 2,000 and 3,000-lb. capacities. This model has been designed for operation in narrow aisles and congested areas.

Compactness of this model, combined with a short turning axle, makes it particularly adapted to working in close quarters. Safety and speedy handling of material is assured since the operator rides in a position where vision is perfect. Operator's comfort has been kept in mind with provision

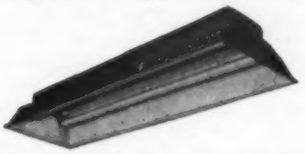


Many plants doing close-tolerance work have found that the "eyes" hold the answer to greater production from present machines. Sight-saving, shadowless lighting has upped production 10-20%.

Screwing in "brighter bulbs" is not the answer; high-level lighting must be carefully planned to avoid glare, excessive contrast. Only experienced specialists in industrial lighting can analyze individual needs.

GRAYBAR offers a full line of modern factory and office lighting units, plus skilled help from lighting specialists. Write for bulletin No. 40 on new fluorescent fixtures which save money while speeding production. Department AM, Graybar Electric Company, Graybar Bldg., New York.

GraybaR
A SINGLE SOURCE FOR
Complete Lighting Service

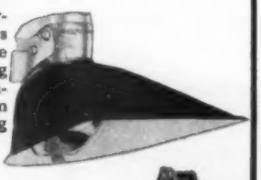


There are many places you can use the new RLM fluorescent lighting units to provide more effective, lower-cost light in plant, office and for sales displays — daylight in a dozen ways.

SILVRAY (silvered-bowl lamp luminaires) — high-efficiency, sight-saving, indirect lighting combined with beauty in design, plus long life, low maintenance cost, easy lamp replacement.

Benjamin Glassteel Diffusers assure soft, even light over a wide range of intensities. Direct and reflected glare is eliminated. Complete with hood, reflector and globe.

Benjamin Duo-Service Floodlights combine a wide coverage diffusing reflector with an intensive beam floodlighting projector.



Crouse-Hinds floodlight projectors, floodlights and searchlights—for yards, sidings, storage tanks, loading platforms and other outdoor areas.

GraybaR QUALITY Everything Electrical GraybaR ELECTRIC COMPANY
OFFICES IN OVER 80 PRINCIPAL CITIES

of a seat and an automobile type tilted steering wheel.

A high capacity, mill type, contactor electrically interlocked with the controller and the operators seat promotes greater safety and relieves the controller of arcing. The travel circuit closes only with the operator in position and controller in first speed position.

A motor-driven gear pump supplies oil under pressure to the hoisting and tilting cylinders through metering valves, the excess by-passed through unloading valves to the reservoir. Lowering is by gravity. The 2,000-lb. capacity truck is furnished to handle loads up to 60 in. long, and the 3,000-lb. capacity model is furnished for loads up to 42 in. long. Standard simple lift is 72 in., and 119 in. is the standard telescoping lift.

"Wedge" Backing Rings Improve Pipe Weld Quality

Quality of welds in many sizes of pipe can be improved materially by the use of "Wedge" backing rings developed by Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, Ohio. Made for pressure piping in all standard sizes up to 8 in., these rings are available in two styles for electric or gas welding.

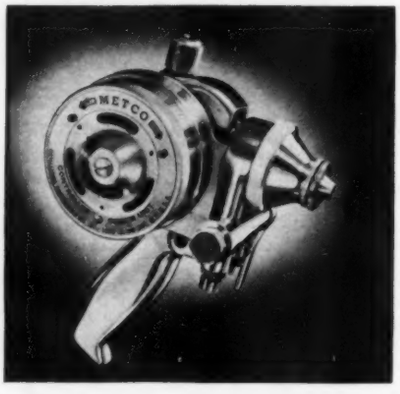
It is claimed that a 100 per cent joint is always insured, as the welding operator is positive of penetrating the inside of the pipe with the first layer of weld metal. Width of the joint is exact at all times, because of the spacing bead in the center of the ring. The inside of the joint is always smooth, thereby assuring minimum flow resistance.

"Metco" Metallizing Gun Burns Any Type of Gas

Acetylene, propane, hydrogen, natural or manufactured gas can be used in the improved Type 2E "Metco" metallizing gun offered by Metallizing Co. of America, 1351 E. 17th St., Los Angeles, Calif. This gun also features a controlled power unit which gives uniform wire feed for production service and eliminates the need for year changes.

Wire is automatically fed into the gun at an adjustable speed, where it is melted by concentrated flame, atomized by compressed air and sprayed on any base material. The gun may be used as a hand tool for coating large structures with zinc, aluminum, lead or other metals, or as a lathe tool for building up worn shafts, rolls, plungers, etc., with steel, stainless steel, Monel metal, bronze, or any other metal obtainable in wire form. Power unit controls wire speed by a governor, operating on the power absorption principle, thus allowing full power input at all times and eliminating speed fluctuations under varying loads and the necessity for changing the gears in the gun. Universal gas head allows operation on any of the usual fuel gases with balanced pressures, without changing heads or dismantling the gun in any way.

In addition this gun has improved



spraying characteristics. Extremely fine coatings are obtained at production speeds, and this combined with simplified adjustments permits continuous operation with speed and quality. Improved nozzle and jet construction reduce gas consumption and result in maximum efficiency and economy. Light weight, perfect balance and easy hand grip combine to eliminate operator fatigue. Maximum air pressure required is only 65 lb. per sq. in.

Holophane "Lobay" Reflector Increases Lighting Efficiency

Designed especially for use with a 400-watt mercury vapor lamp, the No. 645-AL "Lobay" reflector developed by Holophane Co., 342 Madison Ave., New York, N. Y., combines the reflecting efficiency of prismatic glass with accurate directional control of light. There is claimed to be a minimum of wasted light in the high "glare" angle, and a maximum of light delivered vertically, where it is needed. An advantage of the open reflector and ventilated socket construction is rapid lamp cooling to shorten relighting time caused by circuit interruption.

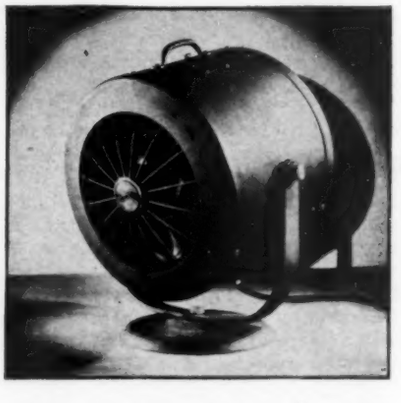
The 30-deg. shielding angle, plus deep construction which keeps the mercury lamp high in the reflector, eliminates glare at all normal angles of view. This is accomplished without

the use of gadgets or other attachments. Smooth inner reflector surface permits easy cleaning. Aluminum cover and non-corrosive fixture parts are virtually impervious to deterioration.

Westinghouse Electric Heater Manufactured in Three Sizes

Outputs of 7,000, 10,000 and 14,000 B.t.u. per hour are delivered by a fan-type all electric unit heater announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Consuming 2, 3, and 4 kw. respectively on either 115 or 230 volts a.c., these units have a swivel bracket designed for both vertical and horizontal adjustment. Over-all dimensions are 16¼ by 13¾ by 11½ in.

A "Corox" heating element is used to give long life, dependable performance and economical operation. The switch for winter operation controls both heating element and fan, and a bimetal thermostat removes motor and heater



from the line in case of overheating. The fan operates independently for summer use. Quiet operation is assured by special motor and fan construction. Baffles direct the flow of incoming air over the motor and protect it from radiant heat. Unusually wide fan blades assure maximum air delivery against any possible back pressure.

Electric Welder Synchronizer Lengthens Transformer Life

Weltronic Corp., 3080 E. Outer Drive, Detroit, Mich., has developed an electronic synchronizer, for use with any non-synchronous timer and power tube contactor, to eliminate transient currents and resulting stresses in welding transformers. Thus transformer life is increased and in some instances smaller transformers can be used.

This device is small and compact, being supplied in a dust-proof steel cabinet approximately 30 in. high, 12 in. wide and 12 in. thick. Since it eliminates the firing relay usually supplied with power tube contactors, it provides for absolute accuracy in timing, even at a rate of operation as high as 1000 welds per minute. The device has an adjustment for any value of power factor encountered in welding transformers.

"Fusion Bonded" Bearing Carries Greater Load

Greater load-carrying capacity at elevated temperatures coupled with longer life, is claimed for the Evans "Fusion Bonded" steel backed, babbitt lined bearing, offered by Curtis Development & Mfg. Co., 3266 N. 33rd St., Milwaukee, Wis. Lining metal of this bearing is claimed to have adherence characteristics which, when applied by a special process, produce a uniform structure with good conformability, embedability, non-scoring qualities and hardness values. Inside diameters from 1.125 to 4.000 in. are available at present.

Buffalo Truck Casters Built With Extra Width

Buffalo Pulley & Caster Co., 182 Breckenridge St., Buffalo, N. Y., has developed a series of extra-wide rubber casters for heavy duty use where floors must be protected against concentrated loads imposed by narrow steel wheels. These casters can be supplied with a steel sleeve in the bore and with Hyatt roller bearings or with Durex self-lubricating bearings.

Improved Protection Provided By "Ipco" Neoprene Suit

Extreme resistance to oil, acids, alkalis and many solvents is provided by the "Ipco" Neoprene suit made by Industrial Products Co., 800 W. Somerset St., Philadelphia, Pa. Suits are also said to

TORRINGTON NEEDLE BEARINGS

take heavy loads, reduce costs

IN WHITE SUPER POWER TRUCKS, BUSSES, AND FAMOUS WHITE HORSE

Anti-friction Torrington Needle Bearings are widely used in White Super Power Trucks, Busses and the White Horse because they easily withstand heavy loads, and provide utmost freedom in movement of levers, rods and arms of controls. No extra lubrication systems are necessary. Needle Bearings have long life, need little attention, reduce maintenance.

Only a small arbor press is needed to install Needle Bearings. And their compactness cuts costs by reducing size of surrounding parts.

If your product can be improved by a bearing with high load capacity, unusually small size, quick installation, and efficient lubrication, investigate the advantages of the Torrington Needle Bearing. Our Engineering Department will be glad to help you incorporate its advantages in your product. For more detailed information, write for Catalog No. 105. For Needle Bearings to be used in heavier service, ask our associate, Bantam Bearings Corporation, South Bend, Indiana, for a copy of Booklet 103X.

THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. • ESTABLISHED 1866

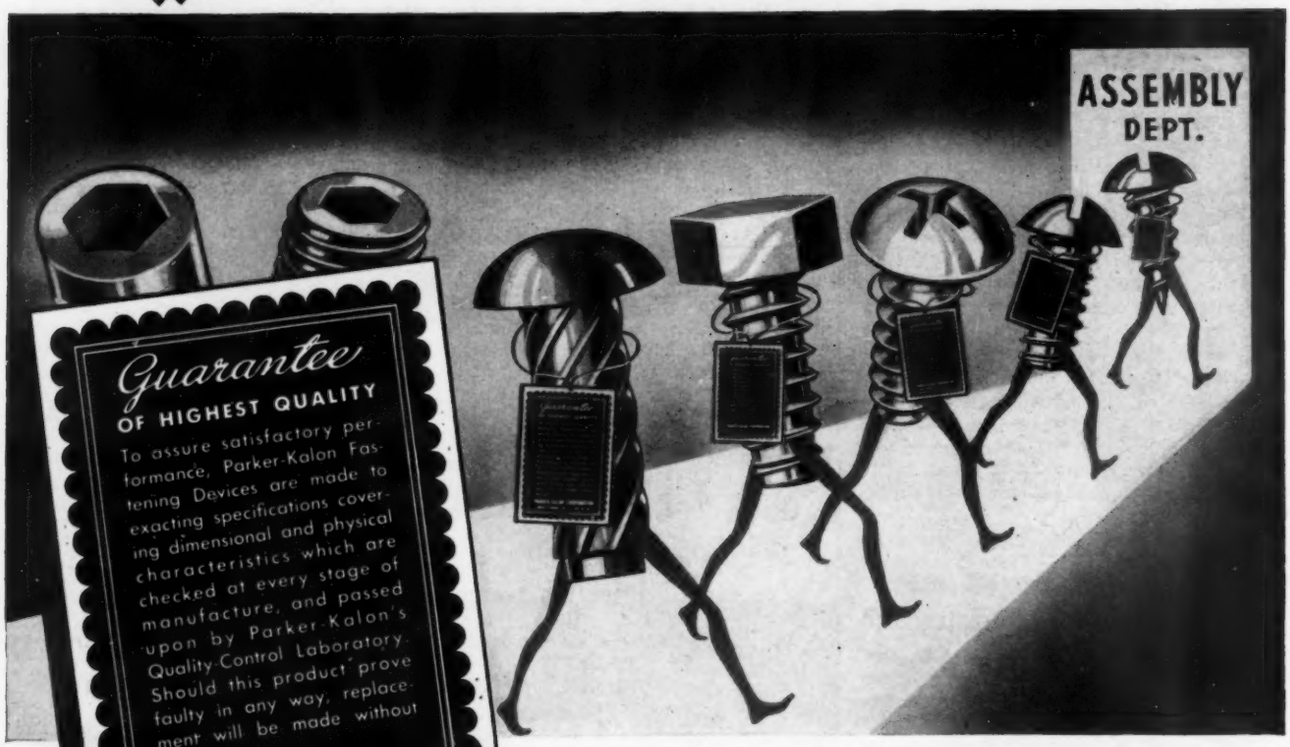
Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit Cleveland Chicago London, England

TORRINGTON NEEDLE BEARING

PASS
Parker-Kalon Screws
To Assembly Dept.

SAFE TO ADMIT
to your Assembly Dep't!


ASSEMBLY
DEPT.
Guarantee
OF HIGHEST QUALITY
To assure satisfactory performance, Parker-Kalon Fastening Devices are made to exacting specifications covering dimensional and physical characteristics which are checked at every stage of manufacture, and passed upon by Parker-Kalon's Quality-Control Laboratory. Should this product prove faulty in any way, replacement will be made without charge.
PARKER-KALON CORPORATION
NEW YORK, N. Y., U. S. A.

Trouble-making "doubtful screws" can't get this "pass" from the Parker-Kalon Quality-Control Laboratory

With competition and defense requirements pressing you to *make it better and FASTER*, your assembly department just can't afford to admit "doubtful screws" – screws that *look* right but some of which don't work right. You need to be sure that EVERY Screw you buy will go in easily and hold securely. For only a few bad ones can slow up assembly work, boost costs and lead to rejected parts in a way hard to believe.

When you use Parker-Kalon, you are free from worry about "doubtful screws". They are barred from your assemblies by Parker-Kalon's famed Quality-Control Laboratory whose unique test-and-inspection routine assures you of physical and mechanical characteristics so essential to unfailing screw performance. Over 50,000 users can attest to the truth of these statements. Parker-Kalon Corp., 194-196 Varick St., New York.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of ....*

Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality

Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

Quality-Controlled **PARKER-KALON Fastening Devices**

withstand the effect of gasoline, naptha, caustic soda, tannic acid, muriatic acid, and hydrochloric acid.

The suit is manufactured in a two-piece style with all seams vulcanized. The jacket has square shoulders, a low stand-up collar, ball and socket snap fasteners. Pants are of the bib type with adjustable suspenders of the same material. Three sizes are available.

Open-End V-Belting
Developed by Goodrich

B. F. Goodrich Co., Akron, Ohio, has introduced a line of open-end V-belting for application on drives where endless V-belts cannot be applied or can be put on only at considerable expense and trouble in tearing a machine apart to get at the sheaves.

Made in maximum 50-ft. lengths, the open-end V-belting is made in top widths of 21/32, ⅞ and 1¼ in. and in thicknesses of ⅞, ⅝ and ¾ in. Angle in each case is 40 deg. Metal fasteners are used.

NEW MATERIALS

Dolph Clear Glass Coater
Protects Against Spatter

Glass articles such as drop lights which are exposed to welding spatter can be protected with the No. 53 clear glass coater developed by John C. Dolph Co., 168 Emmett St., Newark, N. J. This coater is said to be useful for protecting port-hole glass and similar parts during machine or ship construction.

The coater is completely transparent and does not darken under heat. It is generally applied by dipping, and if desired can be easily removed at any time. The coating requires about ½ hr. for drying.

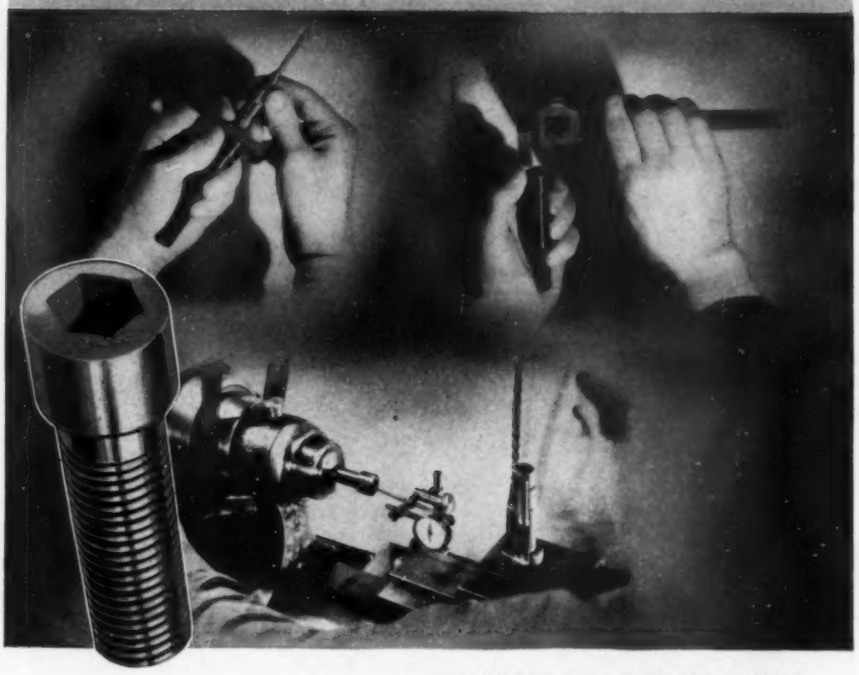
Warren Pulley Covering
Prevents Belt Slippage

Loss of power due to belt slipping on pulleys is claimed to be eliminated with a liquid pulley covering developed by Warren Pulley Cover Co., Danielson, Conn. Suitable for both flat pulleys and V-belt sheaves, this compound is applied easily with a brush. It dries quickly giving an adhesive surface which is not sticky. It is said that one application lasts from one to two years.

"Griptite" Metal Cement
Holds Non-Metallic Materials

"Griptite" metal cement, developed by St. Louis Rubber Cement Co., 3948 W. Pine St., St. Louis, Mo., is particularly suitable for applying rubber, felt, cardboard and other non-metallic materials to metal. This material is waterproof, contains an anti-oxidant, will not deteriorate with age and is supplied to

"DOUBTFUL" SOCKET SCREWS
"BLACKBALLED"!



3 of 16 Precision Steps in QUALITY-CONTROL

16-Point Quality-Control Guarantees
Every Parker-Kalon Socket Screw

Most socket screws are good socket screws. But it takes only a few poor ones in a lot to cause trouble. That's why it pays to specify Parker-Kalon!

For Parker-Kalon gives you complete protection against "doubtful" screws – screws that *look* all right but of which a percentage fail in use – resulting in assembly delays and service complaints. In Parker-Kalon's QUALITY-CONTROL Laboratory – finest in the industry – an exacting 16-point inspection routine assures unvarying uniformity of physical and metallurgical characteristics . . . *eliminates "doubtful" screws.*

You can get this extra protection at no extra cost! Specify PARKER-KALON! Parker-Kalon Corp., 194-196 Varick St., New York.

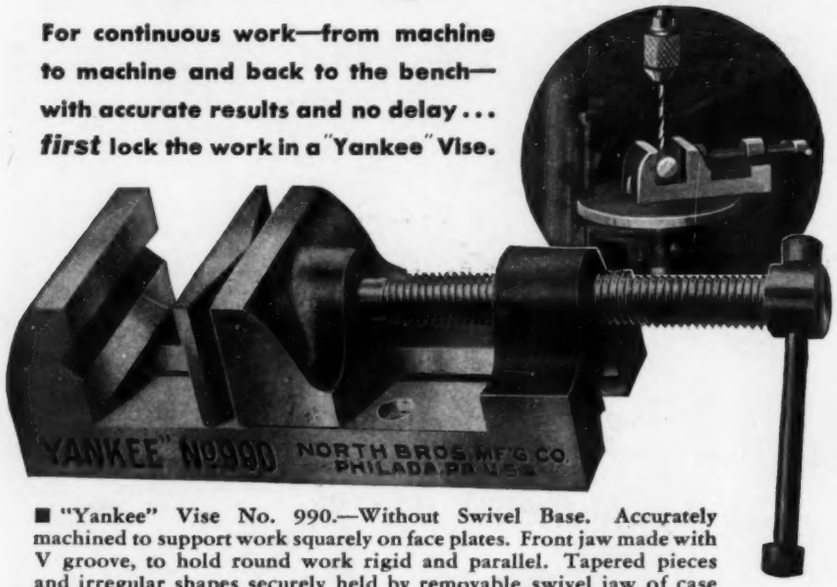
Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

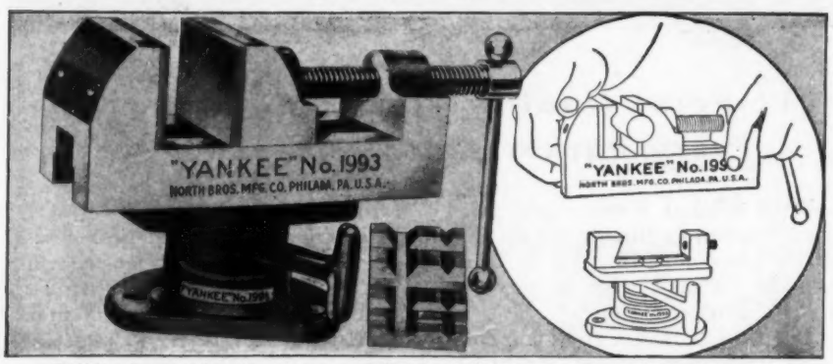
PARKER-KALON
COLD-FORGED
Socket Screws

"YANKEE" VISES stand by the job

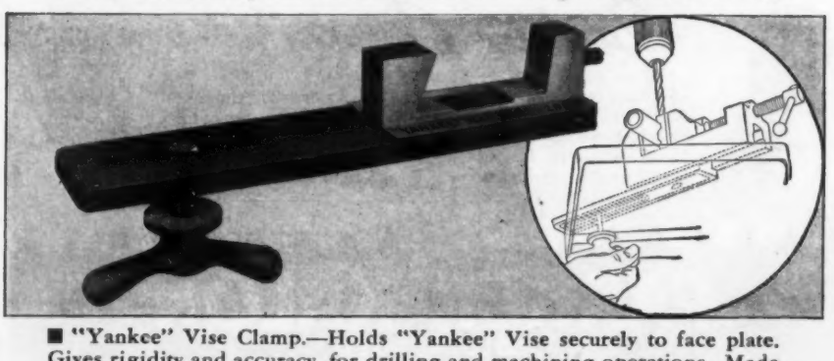
For continuous work—from machine to machine and back to the bench—with accurate results and no delay... *first* lock the work in a "Yankee" Vise.



■ "Yankee" Vise No. 990.—Without Swivel Base. Accurately machined to support work squarely on face plates. Front jaw made with V groove, to hold round work rigid and parallel. Tapered pieces and irregular shapes securely held by removable swivel jaw of case hardened steel. Jaw width, 2⅜". Fastens to bench or face plate with "C" clamp or screws. Not designed for use with "Yankee" Vise Clamp.



■ "Yankee" Vise No. 1993.—With Swivel Base. Accurately machined—sides, ends, base. Removable with work, from swivel base it carries the work in original alignment to drill press and other machines. Made in four sizes with swivel base: No. 1991, 1½" jaw width. No. 1992, 2" jaw width. No. 1993, 2¾" jaw width. No. 1994, 4" jaw width. (Same sizes, *without* swivel base.) Hardened steel block with V grooves, holds rounds.



■ "Yankee" Vise Clamp.—Holds "Yankee" Vise securely to face plate. Gives rigidity and accuracy, for drilling and machining operations. Made in two sizes: No. 2992, for use with Nos. 992 or 1992 Vise. No.2993, for use with Nos. 993 or 1993 Vise.

ORDER from Mill Supply House. For "Yankee" Tool Book, showing time-saving tools, write North Bros. Mfg. Co., Dept. A.M. Philadelphia, U. S. A.

the user in workable condition in various sized containers.

The company has also developed a new vulcanizing cement, "Presto," which is said to be particularly suitable for use in the aircraft industry since it requires no artificial heat or machinery.

Goodrich Exhaust Hose Features Extreme Flexibility

B. F. Goodrich Co., Akron, Ohio, has developed a line of specially constructed exhaust hose for conducting fumes and abrasive dust. This hose is light and flexible, easily bent at short angles so that it may be located at the machine or spot from which the fumes and dust may originate.

Made with smooth rubber tube, helical wire reinforcement plies of fabric and corrugated rubber cover, the hose has ends built for three inches back without wire to facilitate fittings. The hose is manufactured in sizes ranging from 2 to 12 in. in diameter, in 8, 15 and 25 ft. lengths. It is specially compounded to resist abrasion of dust-laden air.

TRADE PUBLICATIONS

BELTS Browning Manufacturing Co., Inc., Maysville, Ky., is circulating Bulletin No. V-156-A which describes the construction and operation of whipcord endless belts.

CHAMBERING MACHINE Pratt & Whitney Co., Division Niles-Bement-Pond Co., West Hartford, Conn., has just published Circular No. 454 which provides performance data and illustrates the construction of gun barrel chambering machines.

DRILL SHARPENER Pratt & Whitney Co., Division Niles-Bement-Pond Co., West Hartford, Conn., has issued a four-page circular, No. 450, which illustrates the construction and operation of deep hole drill sharpeners.

DRILLERS Pratt & Whitney Co., Division Niles-Bement-Pond Co., West Hartford, Conn., has issued a two-page circular, No. 451, which illustrates and provides specifications of deep hole drillers.

HOBBING MACHINES Barber-Colman Co., Rockford, Ill., has issued a two-page folder, No. F-109903, which provides performance data, illustrates and describes the operation of hobbing machines and hobs.

INSULATORS Westinghouse Electric & Mfg. Co. has issued a leaflet, No. 39-180, which describes pin-type insulators for power transmission service. Radio interference proof insulators with ratings between 95 and 200 kw are discussed.

MILLING MACHINES Midway Machine Co., St. Paul, Minn., has just published an eight-page circular describing and illustrating Mill Master Vertical Milling Machines.

MOTORS The Emerson Electric Mfg. Co., New York, N. Y., has issued a four-page leaflet, No. X3941, which illustrates, provides performance data, and describes construction of oil burner motors.

PRECISION GRINDING A 14-page booklet, published by the Dumore Co., Racine, Wis., gives a general description of the care and operation of portable precision lathe grinders. The booklet sells for 25 cents.

PUMPS AND EJECTORS Worthington Pump & Machinery Corp., Harrison, N. J., is circulating Bulletins Nos. W-325-B1 and W-341-B2A, which describe and illustrate the operations and construction of condensate and centrifugal pumps. Also circulated by the company are Bulletins Nos. W-205-B6B and W-205-B8, which provide engineering data and describe the operations of steam-jet ejectors.

PYROMETERS The Brown Instrument Co., Philadelphia, Pa., has just published Catalog No. 1104 which provides illustrations of the interior and exterior views of indicating, recording and control pyrometers.

REAMERS A two-page circular, No. 453, published by Pratt Whitney Co., Division Niles-Bement-Pond Co., West Hartford, Conn., provides illustrations and a description of deep hole reamers.

RIFLING MACHINES Pratt & Whitney Co., Division Niles-Bement-Pond Co., West Hartford, Conn., has issued a four-page circular No. 455, which illustrates the construction and operation of gun barrel rifling machines.

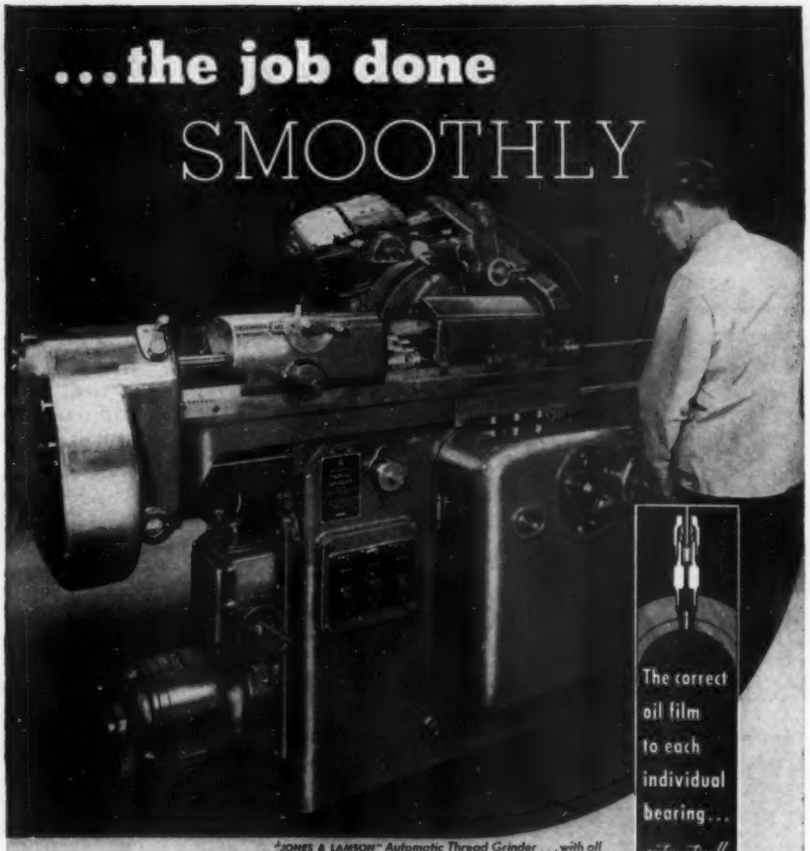
SAFETY TOOLS Ampco Metal, Inc., 1745 So. 38th St., Milwaukee, Wis., has issued a folder which describes non-sparking safety tools.

SWITCHGEAR RECTIFIERS A four-page leaflet No. 31-350, issued from Department 7-N20, Westinghouse Electric & Mfg. Co., describes automatic switchgear rectifiers with ratings up to 550 volts and 600 kw, for mining service. The specifications cover switching units for single and double-unit substations.

VISES The Desmond-Stephan Mfg. Co., Urbana, Ohio has issued a catalog which lists a complete line of machinists and combination pipe vises, production, welders', filers', drill press and milling machine vises.

WELDING POSITIONERS Machines which position welding assemblies is described in Circular No. WP-20, circulated by Cullen-Friestedt Co., 1300 So. Kilbourn Ave., Chicago, Ill.

...the job done SMOOTHLY



"JONES & LAMSON" Automatic Thread Grinder . . . with all bearings except grinding wheel spindle Bijur-lubricated.

● No time is lost from productive work . . . a BIJUR-equipped machine oils itself, while running! Metered oil-feed—the correct oil-film needed by each individual bearing—is supplied automatically. The efficiency of operator and machine is raised . . . precision standards are held . . . maintenance is reduced to a minimum . . . production stepped up!

BIJUR LUBRICATING CORPORATION, LONG ISLAND CITY, N. Y.

1385

BIJUR

AUTOMATICALLY *Correct* LUBRICATION

MEMO

CHECK THOSE NEW MACHINE SPECIFICATIONS. THE BEST MAKES HAVE AUTOMATIC LUBRICATION.

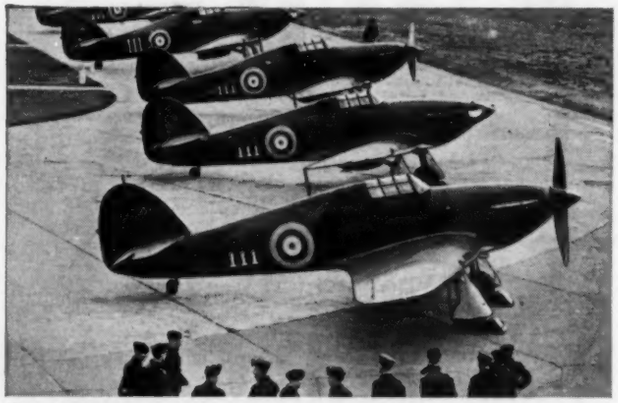
1558

New Kind of Light

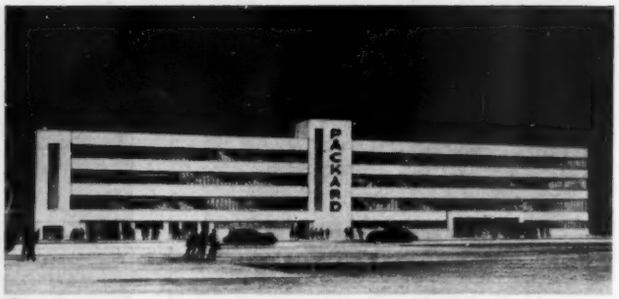
to speed production of fighter planes in 1941

Packard orders 11 miles of new giant-size G-E MAZDA F (Fluorescent) lamps to light new airplane engine plant

1 THIS 1918 FIGHTER helped win World War I. Built by Packard and powered by the famous Packard-built Liberty motor, it helps explain why Packard got order for new Rolls-Royce engines for Hurricane and Spitfire type planes. The ultra-close tolerances of these new engines help explain why Packard is using G-E Fluorescent lighting in its big new engine plant at Detroit.



2 TO KEEP A SPITFIRE'S WEIGHT DOWN to an absolute minimum, engine parts must be finished to flawless accuracy. Under ordinary lighting, inspections alone would create a thousand bottlenecks, because *speed of seeing*... the time it takes your eye to absorb details... is directly dependent on the amount of light you have to see by.



3 PACKARD CHOSE G-E FLUORESCENT LIGHTING because in quality and diffusion, it approaches actual daylight conditions... and because its greater coolness and efficiency permit new high levels of illumination. Packard plant (above) ordered 5820 fixtures each using two 5-foot 100-watt G-E MAZDA F lamps, 13 feet above floor.

4 LABORATORY TESTS SHOW that the light output of G-E MAZDA F lamps has been increased as much as 40% since their introduction in 1938 ... while prices came down as much as 45%. Like other G-E MAZDA lamps, they're made to give maximum light throughout life ... *made to stay brighter longer!*

5 SEE YOUR G-E MAZDA LAMP DISTRIBUTOR for a wide choice of Certified Fixtures, complete with G-E MAZDA F lamps, ready to hang up and turn on. General Electric does not make fixtures, but is glad to recommend certified fixtures bearing the Fleur-O-Lier or RLM tag. For full information, write General Electric Co., Dept. 166-AC-D Nela Park, Cleveland, Ohio

G-E MAZDA LAMPS

GENERAL ELECTRIC

LOWER PRICES ON QUANTITY PURCHASES of G-E MAZDA lamps—$5 worth for $4—$15 worth for $11.25! Also new larger discounts for contract purchasers! See your General Electric MAZDA lamp supplier today!